SCIENTIFIC AMERICAN

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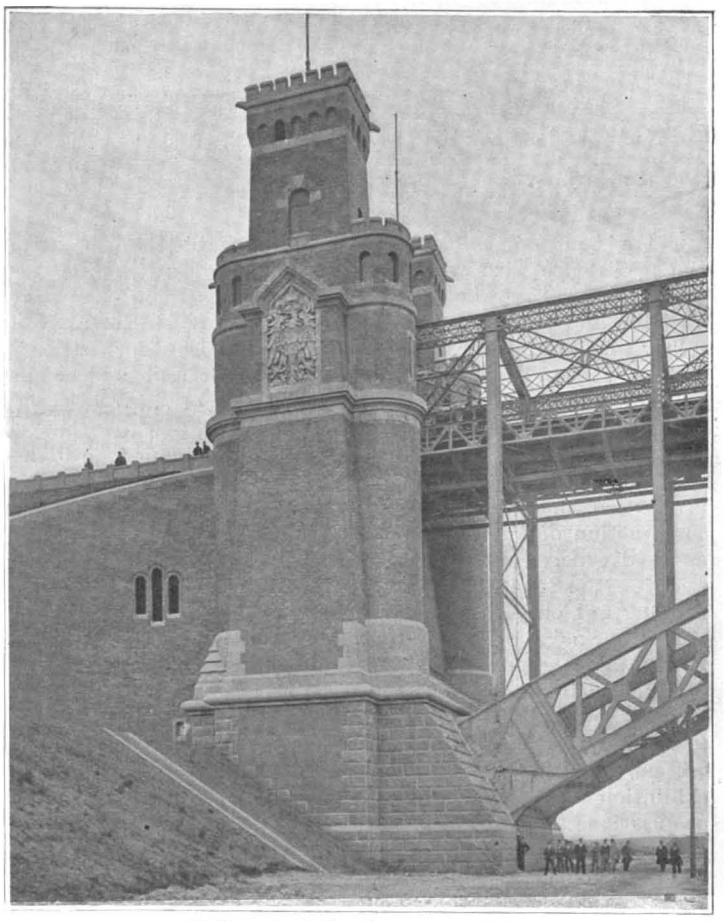
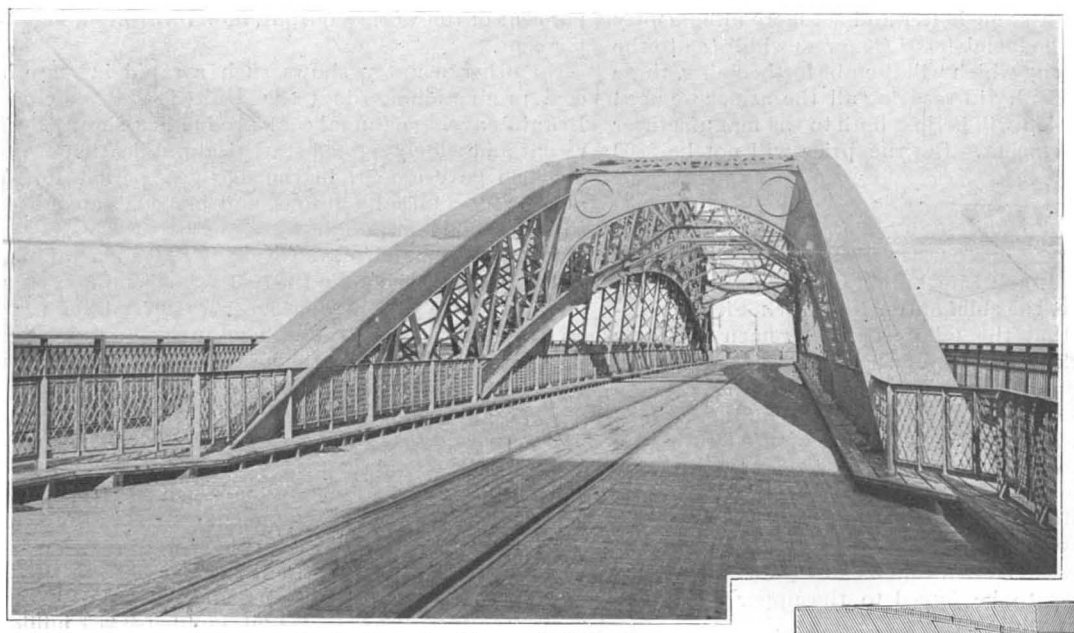
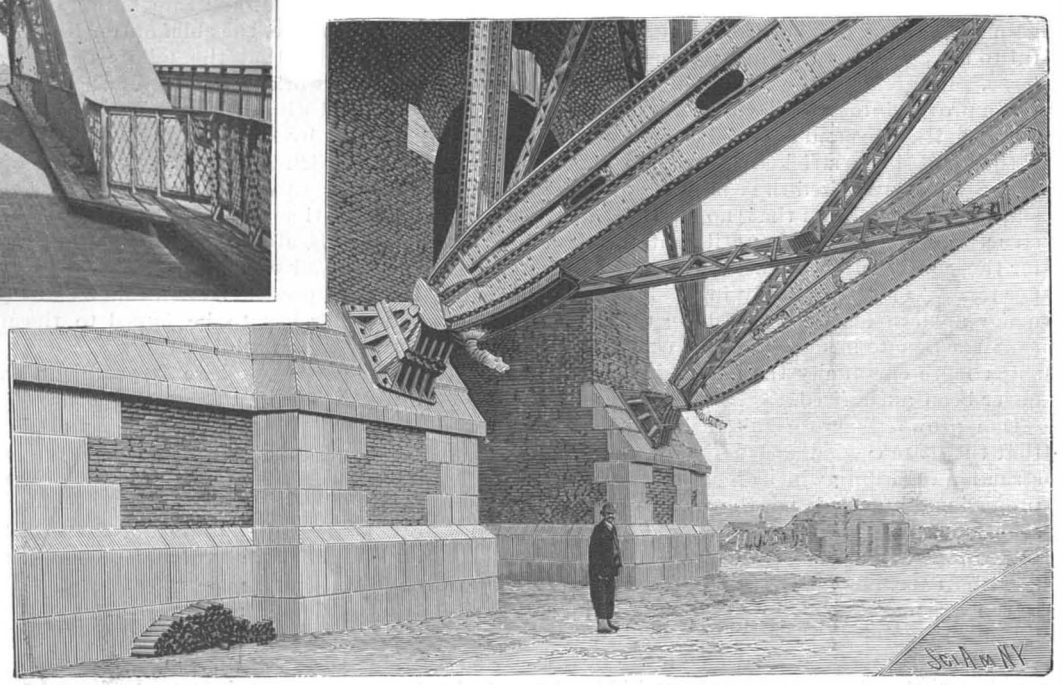
Grunenthal Bridge Across the Kiel Canal. Span, 511·7 Feet.



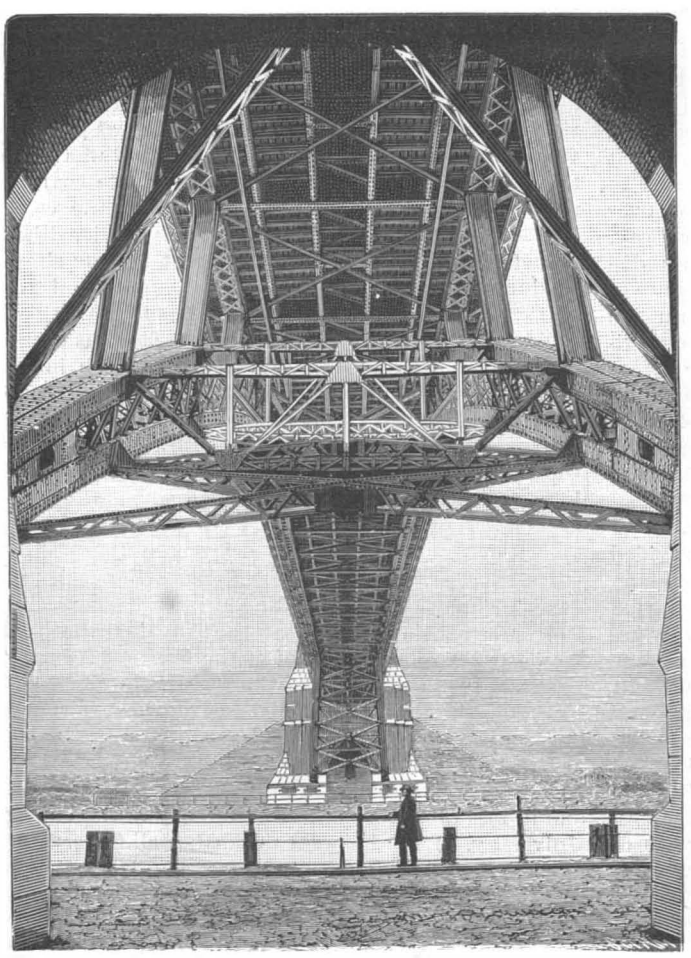
Abutment of the Levensau Bridge.



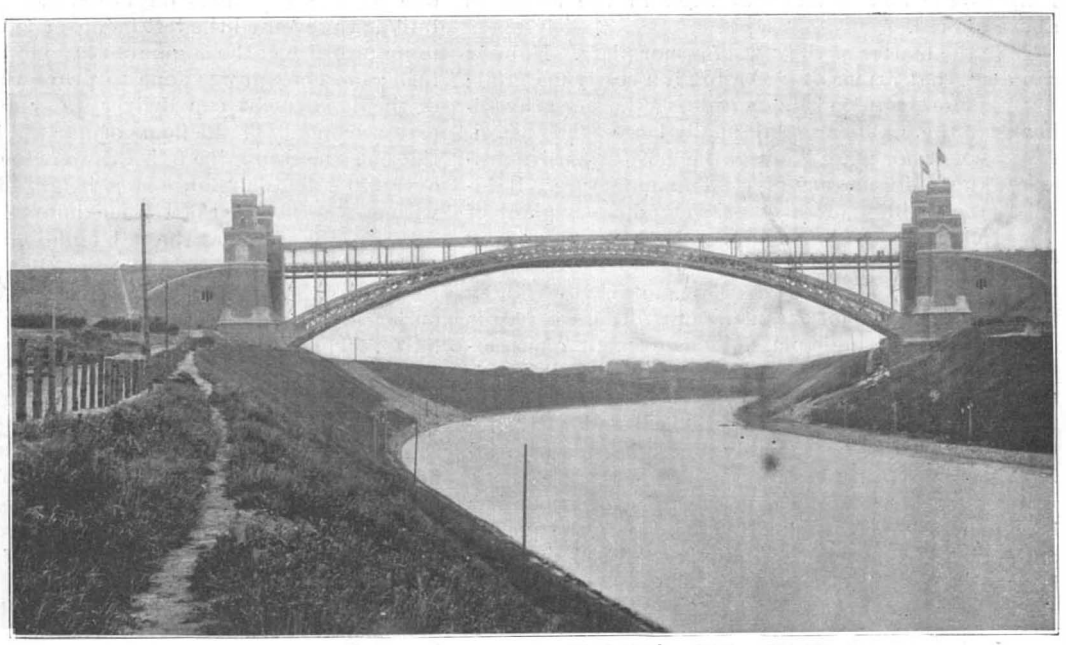
Roadway and Upper Half of Arch—Grunenthal Bridge.



Abutment of the Grunenthal Bridge.



View Looking Along Axis of Grunenthal Bridge, from Below



Levensau Bridge Across the Kiel Canal. Span, 536 Feet.

SOME NOTABLE GERMAN ARCH BRIDGES.—[See page 182.]

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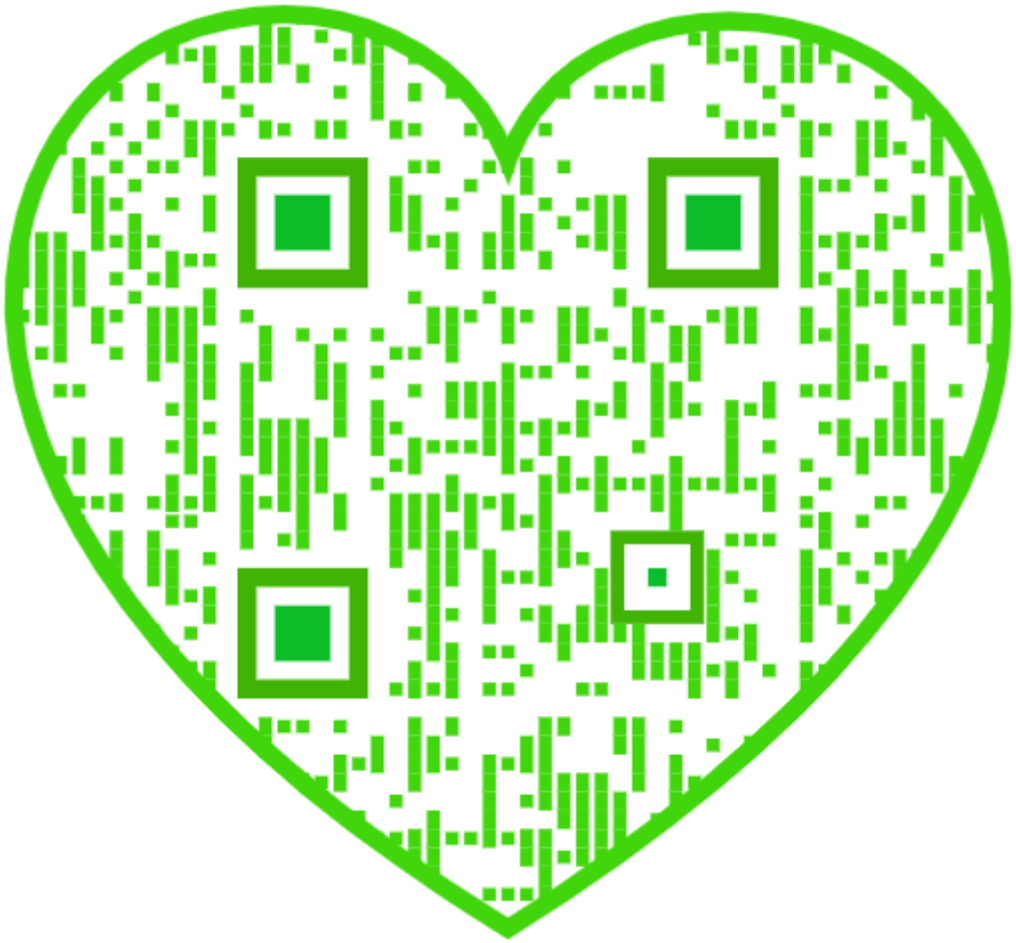

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THE SENATE AND THE ARMOR PLATE QUESTION.

There is only one thing that is more remarkable than the persistence with which the Senate meddles with technical and professional matters, and that is the invariable and inevitable blunders of legislation which follow this interference. In this respect its record for the past session has been a sorry one. First it undertook to teach our naval experts what kind of ships were needed by the navy, and in flat contradiction to the teachings of the late war, and in spite of the protests of the ranking admiral under whom that war was prosecuted, the Senate committed the country to the construction of four vessels of an antiquated and discredited type. Having delivered itself duly upon this question, the Senate clinched its arguments by willfully robbing not only the principals, but the subordinates among our naval officers, of the very promotions which had been proposed as the just rewards of meritorious conduct during the war. Not content with the rank injustice (we had almost said the gratuitous insult) of refusing to recognize the brilliant conduct of our naval officers, the Senate proceeded to still further make an exhibition of itself by cutting down the proposed appropriations for the navy by one-half—a movement which was only checked by the strenuous opposition of the House in Committee.

When the Senate saw that the House was firm in its demand for the construction of the full number of ships recommended by the Naval Board, it proceeded to gain its end by a piece of political jugglery as disgraceful to the Senate as it is humiliating to the country at large. It agreed to the construction of the ships, but put a proviso into the bill which blocks the construction of the battleships and armored cruisers as effectually as if they had been stricken out of the bill altogether. The Senate authorized the construction of the armored ships on the condition that no contract for their construction should be made until contracts had been let for the construction of their armor at a price of $300 per ton. As it is absolutely impossible for any firm to make modern armor for $300 per ton, it will be seen that the Senate has blocked the construction of these ships more effectually than if their construction had never been authorized.

One grows weary of reiterating the commonplace that there are certain matters for information and instruction regarding which Congress must rely upon the professional knowledge of the various bureaus. While senators and representatives should endeavor to obtain a general familiarity with the affairs of the technical bureaus, no one expects them to become so versed in the various subjects upon which they have to legislate as to be able to discuss the technical questions involved in the recommendations made by the various expert boards. If they do so, they will blunder as foolishly as the Senate has blundered in the instances above quoted.

Take the matter of the cost of armor plate. Nobody can deny that armor at $550 a ton is a costly material; but because the price is high, it does not necessarily follow that the profits are abnormally large. The manufacture of armor plate is one of the most expensive processes known in the art of steel manufacture. It involves the building of an extensive and costly plant of a special type, which must necessarily occupy many months in its erection; and an armor plate company never knows but what new developments in the art may render a large part of the plant out of date before it has turned out a single plate. This element of uncertainty alone justifies the manufacturer in placing a high price upon his finished product, and if he makes the armor plate pay for the periodical and costly renewal of his plant, he is merely protecting his own interests in a perfectly legal way.

Moreover, every increase in the price of armor has been marked by a corresponding increase in the quality of the plate. The Senate is greatly exercised over the increase of $50 to $75 per ton in the cost of the new Krupp armor over the Harveyed armor. Yet the tests thus far made indicate that the Krupp plates show a superiority of about 25 per cent over the Harveyed plates, and, ton for ton in point of powers of resistance, the Krupp material at $550 to $575 per ton is cheaper than Harveyed armor at $475 to $500 per ton. Moreover, in comparing the prices asked by American manufacturers of this government with those being actually paid here and in Europe, we find that there is nothing exorbitant in the demands of our armor plate makers. In England the price of Krupp armor ranges from $515 to $569 per ton. In this country the Cramps are paying the American manufacturers $575 per ton for Krupp armor for the Russian battleship now building at their works, although they were at liberty to procure this armor from any other source. Russia is now buying in the United States the ordinary Harveyed armor at $486 per ton, because this is cheaper than they can procure it elsewhere.

In view of these facts, which have been furnished us from an official source, what, we ask, becomes of the Senate's demand that the armor for our new battleships and armored cruisers shall be furnished for $300 per ton? No manufacturer in the world is going to deliver plates for United States warships at 50 per cent less than the cost of manufacture.

It is no thanks to the Senate that the situation, as regards the vessels just authorized, is not as bad as it seems. It happens that the armor plate makers' hands are so full that no delay will be occasioned in the construction of the new ships, if Congress only rectifies the mistakes of the last session when it meets again in December. The present contracts for the vessels of the "Alabama" class and for a Russian battleship will keep the mills busy until February, 1900. The 10,000 tons required for the "Maine" class and the monitors will not be completed before the summer of 1901, before which time nothing could be done for the new ships. By the time Congress meets, a lot of Krupp armor, now being made for Russia, will have been tested at the naval proving ground and the department will then be in possession of additional information which will enable Congress to understand the armor plate question better and act more intelligently upon it. If the members of Congress will listen to the expert testimony which will then be forthcoming, there will be no difficulty in securing all the armor we need at a figure which will be just both to the manufacturer and the government. But the price will not be $300 per ton.

FIRE PROTECTION OF TALL BUILDINGS.

It will be remembered that when the upper eight stories of the Home Life building were burned out in the recent fire, the chief of the New York Fire Department stated that the failure of the firemen to do any effective work above the ninth story was what he had predicted whenever one of these tall buildings came to be tested by a serious fire. There is a limit of height above which the ordinary methods of fire-fighting by pumping water through a hose are inadequate. Much valuable time is lost in dragging the hose from floor to floor; it is always liable to injury from fire or falling debris; and of course there is the danger of bursting from overpressure, a risk that naturally increases when the water has to be forced to the upper floors of a twenty-story building.

The New York Fire Department has recently made a test of the height at which an effective stream of water can be delivered from its engines, which shows that our tall buildings are better protected than is generally supposed. A fire engine was connected to the mains and to a standpipe that extends the full height of the St. Paul building, and succeeded in forcing a considerable stream of water from the roof—at a height of 307 feet above the street level. With a pressure of 180 pounds at the engine, the water was thrown over St. Paul's Church, on the opposite side of Broadway, and fell into the churchyard beyond, a horizontal distance of about 250 feet. Unfortunately, the failure of one of the couplings on the standpipe within the building prevented the test being made with the maximum pressure at the engine of 300 pounds to the square inch; but enough was done to prove that the engines of the department can deliver water at a satisfactory pressure on any of the floors of our tall buildings. At the time the standpipe failed the engine was throwing over 250 gallons a minute at a height of over 300 feet, with only 60 per cent of the maximum pressure.

While it is true that the tall buildings are provided with their own fire service in the shape of tanks on the roof or special fire pumps in the basement, experience has shown that the system is not very reliable. The tanks are liable to be empty, or the pumps may not be available because of insufficient steam supply in the boilers, or the whole plant may be crippled by the flooding of the basement during the progress of a fire. But by the new system, if a fire should break out in a building supplied with adequate standpipes and a good elevator service, the firemen will be enabled to command a good service of water on any of the highest floors within a few minutes after reaching the scene of the fire.

The failure of the standpipe in the St. Paul building suggests that the fire system of these tall structures should be put in under the rigid inspection of the Building Department; that it should be of ample capacity; and that it should not be passed by the department until it has been subjected to a test pressure considerably beyond that which will obtain in actual service.

A further development of the idea of having the service of these buildings operated by the engines of the Fire Department would be to lay down separate salt water mains at stated intervals from Broadway to the Hudson and East Rivers, with connections at the water front to enable the powerful pumps of the fireboats to be concentrated upon a fire. This system is already installed in some Western cities, and it provides a supply of water far in excess of anything that could be secured by the use of the ordinary fire engines. A combination of both systems and the provision of ample standpipes in every tall building would render these structures practically proof against destruction, so great would be the flood of water that could be let loose upon a fire. It should also be borne in mind that these towering buildings would not only be indestructible themselves, but they would afford an excellent protection against the spread of a conflagration. Their great mass would form an efficient fire-screen, tending to localize an outbreak, while they would serve as giant watertowers, from the upper floors of which a vast amount of water could be thrown upon the burning buildings below.

COAL PRODUCTION IN THE UNITED STATES.

The announcement that the rapid increase in exportation of coal from the United States is causing uneasiness among British coal producers and exporters lends interest to some figures on the coal production of the world, and especially of the United States, just issued by the Treasury Bureau of Statistics. From these it appears that the coal production of the United States is now nearly five times as much as in 1870, that the exportation has in that time increased from a quarter of a million tons to over four million tons, and that the United States, which in 1870 supplied but 17 per cent of the world's output, now furnishes about 25 per cent.

No other country shows such a rapid increase in coal production as does the United States. Great Britain's average annual coal product, as shown by a recent and widely quoted statistical publication of the Swedish government, in the five year period 1871–5, amounted to 127 million tons, and in 1891–5 amounted to 185 million tons, an increase of 45 per cent in the average annual output. Germany's average annual coal product in the period 1871–5 was 45 million tons, and in the five year period 1891–5 was 97 million tons, an increase of 115 per cent. The average annual coal production of France in the year 1871–5 was 16 million tons, and in the term 1891–5, 27 million tons, an increase of 70 per cent. The average annual coal production of the United States in the period 1871–5 was 45 million tons, and in the period 1891–5, according to our own figures, was 132 million tons, an increase of 193 per cent. The average annual output of "other countries" not individually specified was, in 1871–5, 34 million tons, and in 1891–5, 79 million tons, an increase of 132 per cent. The total average annual output of the world in 1871–5 was, in round numbers, 266 million tons, and in 1891–5, 520 million tons, an increase of 95 per cent. Omitting the United States, the annual output in 1871–5 averaged 221 million tons, and the average in 1891–5 was 388 million tons, an increase of 75 per cent.

Both the area of coal production and quantity produced have increased greatly in the United States. In 1870 the number of States in which coal was produced was but twenty, while in 1897 the number was thirty-two. In 1870 the production of anthracite coal was reported only from Pennsylvania, while the census of 1880 reports production in Pennsylvania, Rhode Island, and Virginia, and more recent reports show a production of anthracite coal in Colorado and New Mexico. In the South the increase has been especially rapid. Alabama in 1870 mined but 11,000 tons of coal, and in 1897, 5,262,000 tons. Keutucky, which in 1870 mined but 150,000 tons of coal, produced in 1897, 3,216,000 tons. Tennessee increased her output from 133,000 tons in 1870 to 2,500,000 tons in 1897; and Virginia, which produced but 62,000 tons in 1870, produced 1,365,000 tons in 1897.

PROF. NEWCOMB'S SUCCESSOR.

Prof. Thomas J. See, of Missouri, who was recently Professor of Mathematics at the Naval Observatory, has been designated as Chief of the Nautical Almanac, to succeed Prof. Newcomb, who retired March 12, 1897. Prof. See is already a noted astronomer, although he is only thirty-three years of age. After graduating at the State University at Columbia, Mo., he took the degrees of Ph.D. and M.A. at the University of Berlin and in 1899 took the chair of astronomy in the Chicago University. Later he went to the Lowell Observatory at the city of Mexico and thence to Flagstaff, Ariz. At the last named place he discovered no less than six hundred double stars. Prof. See's discoveries regarding celestial heat have caused some scholars to change their opinion of the nebular hypothesis of Herschel and Laplace.

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CARRIAGE TIMBER SUPPLY.

The ruthless destruction of our forests in all parts of the country has at last affected the carriage and bicycle trade, and there are those engaged in this business who contend that within the next quarter of a century the trade will fall short of its needed supplies of elm, hickory, ash, and whitewood, the principal woods employed in making carriages and bicycle rims. So long as the lumbermen confined their attention to the spruce and pine forests, the carriage manufacturers gave no thought for the morrow; but when the demands of modern industries made heavy drafts upon the special trees reserved for this trade, the matter assumed a different aspect. The cabinet makers wanted more variety for their interior work, and they experimented with oak, ash, cherry, walnut, elm, hickory, and birch. One after another had its day, and then declined to go the way of all fashionable woods which are employed too immoderately. Some of the best cabinet woods have almost totally disappeared from our forests, and others are rapidly approaching the same condition. Forty years ago walnut forests were so plentiful that farmers simply had to clear their lands to ship large quantities of timber to market; but to-day the supply of walnut is confined chiefly to the few groves which are planted for their nuts as much as for their timber. Cherry is likewise becoming scarce, and furniture and cabinet makers are looking for substitutes. Birch and maple are receiving the most attention just now from the timbermen who supply native woods to the furniture mills, and it is fair to assume that they will decrease as rapidly in quantity as walnut and cherry.

The carriage trade is far less elastic in its choice of woods than the cabinet or furniture trade. The manufacturers of the latter have found substitutes for their fashionable woods as fast as the supply gave out, and they have consequently never felt cramped: in fact, it has been to their interest to change from one wood to another; for by so doing they set a new fashion, and created a demand for another style of furniture. But the more conservative builders of carriages have clung to the woods that their forefathers used a hundred years ago, and, unless the supply gives out, they will stick to the same woods for another century.

Forest ash and whitewood are considered indispensable for carriage building, and what concerns the trade more than anything else is that the second growth of these trees never answers the purpose so well as those first growth trees which mark the primeval forests. The whitewood is used for the panels of the carriages, and the wood must be close-grained and very smooth. A second growth tree usually produces wood that is coarse grained and totally unfit for carriage panels. The forest ash is light, yet firm, strong and resilient, but not elastic, and with a very fine grain and uniform texture of wood. These qualities, which make forest ash so desirable for carriage building, are not so apparent in the wood taken from second-growth trees. The wood is hard, elastic, heavy, and tough, and, in order to make it retain its form, it has to be stayed with metal. For the framework of heavy carriages it is totally unfit.

Not only is the carriage trade particular in securing forest ash and whitewood from original forests, but the trees are selected by experts while they are standing. Not every tree will answer the exacting demands of the builders of fine carriages and wagons. Trees growing in openings rarely have a uniform grain, and only those found in forests where the foliage shuts out the rays of the sun from the trunks are deemed fit for the trade; consequently, many of the ash trees that may appear all right to the average lumberman will not do for the carriage builders. With no prospect of increasing their supply by artificial cultivation, the carriage trade has more reasons for alarm at the rapid disappearance of the original forests of ash and whitewood than any other. Of course some experiments have been made with other woods as substitutes for the forest ash and whitewood. Thus basswood is used quite extensively as body panels, and this wood is not quite so much injured by being artificially raised, although the forest basswood is superior to the trees of second-growth.

Hickory has its place in carriage building that has never yet been displaced by any other wood or artificial substitute. For light spokes it has no equal. Ironwood and lancewood are used in its place for heavy spokes, where the weight is of less importance than the strength and cost. But for light buggies and carriages hickory spokes must be used for years to come, as it has been in the past. Forest ash sometimes takes its place, but the result is never so satisfactory.

Unlike either the ash or whitewood, hickory, to be of any use, must be cut from second-growth trees. The hickory trees are therefore raised artificially for the trade, and by a little training they can be made straighter and more uniform in appearance. Most wild, first-growth hickory trees are the personification of crookedness and evil shape. In the cultivated trees some of this tendency to grow scraggly and unsymmetrically can be corrected, but not entirely. The inherent tendency of the tree will still assert itself. In recent methods of testing wood considerable light has been thrown upon the relative strength of different woods. It was formerly believed that coarse-grained, second-growth hickory raised upon lowlands was stronger than a piece of hickory of the same size grown upon the uplands. The latter certainly weighed less, about ten per cent, and its grain was finer and smoother. For many years the lowland hickory was used by the carriage builders in preference to the upland; but modern wood tests show that the lighter upland hickory will sustain from 10 to 15 per cent more weight before breaking than the coarse-grained hickory from the lowlands. In the best trade the upland, second-growth hickory is always selected.

The large carriage builders are so particular in their selection of forest ash, whitewood, and second-growth hickory that they take nobody's word for it except their agents', who go out into the forest and select their own trees, and have them cut under their supervision. The wood consequently costs the carriage makers far more than the ordinary timber that one can purchase in the open market. Then the wood has to be seasoned and cured according to certain methods that have long obtained in the trade. There are certain timbermen who have earned the reputation of carefully selecting their wood while growing, and these are trusted by certain established houses who make fine carriages and wagons. The importance of this selection is manifest in other ways. In order to secure the best timber for carriages, and incidentally for wooden bicycle rims, the trees must be cut just at the time of their maturity, when the wood solidifies. This point is kept well in mind by the woodsman who selects the trees. The first test the expert applies is that of examining the bark. By the appearance of the bark he can tell whether the tree is still growing, whether it is just ripening, or if it is at a standstill or decaying. The latter has to be avoided particularly. After a tree reaches maturity it soon goes into its dotage, and decay follows. Its timber is then of little use to the carriage builders. The bark test is something that cannot be communicated to another. It consists in examining the color, the rings, and the general roughness of the outside, and the sappy condition of the inside. One must learn from long experience to determine the condition of a tree by the bark.

A more infallible test is that of watching the terminal leaf. Until the tree reaches full maturity the terminal leaf will form on the branches. When the tree has passed this period of its life the terminal leaves will disappear, or, rather, fail to form in the spring. In time barren branches will appear in place of the terminal leaves. This is the sure sign that decay has commenced and the pith of the tree is drying up. The tree has ceased to grow then, and it is only a question of time before the heart of it will rot.

It is not only necessary to secure trees for carriage timber that have no signs of decay at the heart, but it is essential that they should not have passed the period when the terminal leaves have ceased to appear. The bark test might answer for logs already cut, but the test of the terminal leaf could not be applied to timber cut down and trimmed of all branches. It is for this reason that the experts are required to select the trees while standing. While trees must reach maturity, they must also be growing, A tree that has actually ceased to grow is condemned.

There is a scientific reason for this that is well understood by good timbermen. The sap of the forest trees changes with their growth, and the condition of the sap affects the quality of the timber. The sap of young, healthy trees is rich in saccharine and glutinous qualities, and as they get older these decrease. The sap in time becomes thin and watery. The glutinous and saccharine material of the strong sap gives toughness and fiber to the timber. It is a mooted question among lumbermen how soon decay sets in after full maturity is reached. At this period the saccharine predominates over the glutinous material, and decay does not begin until the sap grows watery. It is believed by some expert lumbermen that the trees improve for a few years after reaching maturity, as the wood solidifies and grows stronger in texture. But when the "stag horns" appear on the topmost branches, then the tree has passed its best period of usefulness. Decay has begun at the heart and the topmost branches. It is impossible to say how far the decay has extended by any known tests until the trees are cut down. Even then the logs may have all the appearance of prime, first-class timber, and the weakness at the heart cannot be detected until the logs have been cured and seasoned. The grain may not be affected to all outward appearances when seasoned, the color may be good, and similar external appearances be satisfactory to the eye; but when subjected to modern tests a different story is revealed. The life is out of the wood, and it is brash and devoid of all elasticity. Such timber would be worthless for carriages or bicycle rims. It follows that, in order to secure proper wood for this most important trade, the trees must be selected while growing in midsummer, when the foliage is full, marked for future use, and then cut in the late fall or winter, when the watery part of the sap is at a minimum.

Even with all of these careful scientific tests, the trees selected by the experts will sometimes prove bad. There is no accounting for the freaks of Nature. Of two trees growing close together which answer all outward tests and external appearances, one will be good and the other may be fit for firewood, and nothing else. Why Nature breaks her ordinary rules at times is more than any one can explain; but she does it, and with a vengeance at times that is costly to those whom she deceives.

One tree that has long held sway in the carriage trade is gradually being replaced by others that are considered equally good For years all light hubs were made of elm. Nothing else was supposed to make good hubs, and the elms were rapidly cut down to supply the trade. Fortunately, when the elms are about all destroyed, except those in groves and streets, the builders of carriages are beginning to accept birch, locust, and gum, which many consider equal, if not superior, to elm for carriage hubs. G. E. W.

CHARACTERISTICS OF PORTO RICO.

Mr. Henry M. Wilson, of the United States Geological Survey, spent December and January in Porto Rico, and recently gave an interesting lecture before the Brooklyn Institute on "The Geography and Natural History of Porto Rico." He spoke of the island as teeming with fertility, especially in the northern half, which is copiously watered by clouds driven in by the trade winds, and as being of a temperate climate, the mercury seldom rising above 90° in the summer and rarely falling below 60° in the winter. Even the summer heat is tempered and made endurable by the trade winds that blow with great uniformity.

The population of Porto Rico is, said Mr. Wilson, 315,000, of which more than 120,000 were of the negro but not of the West Indies type. Throughout the island, from east to west, stretches a system of mountains or sierras; the general aspect of the island from the sea is mountainous, and from the interior rugged, yet pleasant, on account of the cultivation. The geological formation is simple and generally uniform throughout. On each coast is an alluvial plain graded by sediment from the rivers, and between the river mouths is growing coral rock. Inside the formation is tertiary white limestone. The mass of the island is occupied by volcanic rock, porphyry, and gneiss, mixed with heavy calcareous limestone. Porto Rico is poor in minerals. No evidence has yet been found of any minerals existing in commercial quantities. Gold is found east of San Juan in very small quantities. Climatically the island is divided into two parts; the northern humid and the southwestern semi-humid to arid.

Prof. Harrington averaged the annual rainfall at San Juan at 54 inches, yet fifteen miles to the east the average rainfall is 123 inches. This is accounted for by the trade winds that are arrested by the mountains and which deposit their moisture. The island has a wet and a dry season. The soil is very fertile and in the central part the fields are green and large quantities of tobacco are raised. On the south and southwest the sugar cane is the chief product. It grows to 12 and 15 feet in height and is nearly as thick as a man's arm. On the mountains coffee grows above an altitude of a thousand feet, and the higher the elevation, the better is the quality. There are vegetables of all kinds, and all the flowers that are raised in hothouses in America grow wild there. Ferns, mosses, and orchids grow on rocks. There are no wild animals, and domestic animals flourish well, specially cattle. Porto Rico is emphatically the land of the small farmer. There are 21,000 individual holdings, and only 1,000 of them are owned by sugar and tobacco planters.

ANTARCTIC EXPLORERS LAND.

A dispatch from Port Chalmers, New Zealand, says that the steamer "Southern Cross" has arrived there from Victoria Land, where she landed Borchgrevink and ten of his companions of the Antarctic exploring expedition. Borchgrevink left Tasmania some five months ago. He will start on a sledge journey inland in October, for the purpose of getting as near the pole as possible and also of collecting botanical and mineral specimens. It is thought that the expedition will return in about two years. It will be remembered that the explorer visited Victoria Land in 1893 for commercial purposes with very indifferent results.

FATALITIES on the street railroads of Chicago have decreased nearly eighty-five per cent since the surface lines have equipped their cable and electric cars with fenders, in accordance with an ordinance. In the last two months only three persons were killed on the street railways of Chicago, whereas in the same period of 1898 there were eight victims, and the average for half of last year was nine deaths each month. All the surface roads have not as yet fulfilled the requirements of the ordinance, and it is probable that the number of fatal accidents will be even smaller when every car is provided with a fender.

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The Winds of the Sahara.

Most interesting meteorological observations made in the Sahara during eight excursions between 1883 and 1896 have been published by M. F. Foureau, an abstract of which has been published in Popular Science Monthly. The most frequent winds are those from the northwest and southeast. Every evening the wind goes down with the sun, except the northeast wind, which blows all night. There is also a warm wind from the southwest charged with electricity and often carrying fine sand and darkening the atmosphere. The compasses are much disturbed by it, because, it has been suggested, of a special condition produced upon the thin glass covers by the friction caused by the rubbing of the fine wind-carried sand upon them. But it has been observed that the spare compasses show the same disturbed conditions as soon as they are taken out of their boxes. The disturbance ceases when the glasses are moistened, and does not appear again until they have dried. Several hail stones were noticed. They were usually about as large as peas, but were larger in the heavier storms. He observed no snow in the Sahara, but was informed that snow falls in the winter on the tops of the mountains. Similar observations have been made by other travelers. A curious mirage phenomena was sometimes observed. He found frequent fulgurites in which sand had been vitrified by lightning strokes.

A CURIOUS MEANS OF DISPOSING OF THE DEAD.

The vicissitudes of the dead would furnish material for an interesting and grewsome volume. We are, of course, not surprised when we see an Egyptian mummy, but it is very extraordinary that during the Middle Ages and the Renaissance a species of mummification was also adopted in Italy, and even continues to this day. The two most curious examples of this are the cemetery of the Capuchins, in Rome, and the catacombs of the Capuchins, at Palermo. In the latter place, we believe, bodies are still added; though probably not in the Roman Capuchin cemetery, as intramural interments are forbidden in Rome even to Popes. Our engraving represents the catacombs of the Cappuccini, at Palermo. They consist of a series of chambers which are well lighted, adding to the ghastliness. Here are to be seen the mummies of the dead of the better classes, in the convent vaults. They are fully attired, even down to the white kid gloves. Some are erect against the wall, and others again buried in chests, while some sit in chairs, all ticketed with their names and dates. Every year or two the gloves, and less frequently the clothes, are renewed by the affectionate survivors, who go on great feast days of the church to gladden their eyes with the family mummies. A visit on the eve of All Souls' Day is a thing long to be remembered. Lights flare dimly through lanterns of bone, revealing the hideous forms of the dead. The bodies against the walls appear like malefactors who had been hung. Many of the bodies appear shabby as regards dress, as their friends do not give them a posthumous toilet from time to time, which is so necessary to keep them in good repair.

The cemetery of the Capuchins, in Rome, is fully as interesting and ghastly. It is a series of vaulted chambers above the ground, so that there is no need of artificial daylight. Around the walls skulls and other bones are arranged in patterns. The ceilings are covered by ornamental patterns made of smaller bones, and lamps depending from the ceiling are also made from bones of the arm.

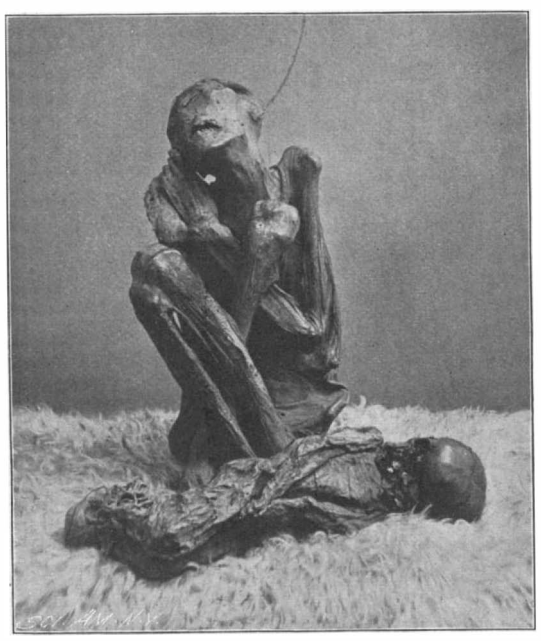
After a monk dies he is buried for a term of years in the ground in the chapel, the earth being brought originally from Jerusalem. His bones are then taken out and help to deck the grewsome chambers. A few monks of particular sanctity are not buried at all, but placed against the wall and dried in situ.

THE CATACOMBS OF THE CAPPUCCINI, PALERMO, SICILY.

DISCOVERY OF TWO INDIAN MUMMIES.

BY J. M., BALTIMORE.

Two white men, while out on a hunting and prospecting tour in the Cascade Mountains recently, discovered some genuine Indian mummies. There were two bodies that had been preserved, in some manner, so as to measurably resist the ravages of time and the encroachments of decay.



INDIAN MUMMIES DISCOVERED IN THE CASCADE MOUNTAINS.

These bodies had originally been incased in the skins of some wild animals. Evidently some preservative substance was used to prevent decomposition. The skins had been wrapped snugly around the bodies and securely fastened, so as to exclude the air as far as possible. As the flesh shrank the covering also shrank, until it fitted as tight as the natural skin.

In the long lapse of time, flesh, bones, and covering became very dry and as hard as horn. How long these bodies had remained in this mummified condition it is impossible to determine. To what tribe the mummies once belonged no one can tell. The object in thus preserving the bodies is also shrouded in mystery. As a usual thing, Indians never mummify the bodies of their dead.

Indians who have been shown the mummies and questioned have invariably shaken their heads in an incredulous manner, and looked puzzled and mystified. They have not been able to throw one ray of light on the subject.

The mummies were found in a small cave, situated at the base of a lofty, rocky bluff. Their discovery was purely accidental. The two men entered the mouth of the little cave merely out of curiosity, and were surprised on discovering the mummified bodies. Careful search and investigation failed to discover more bodies.

As near as can be ascertained, these mummies were found near the headwaters of the Santiam River, in the very heart of the Cascade Range.

The men making the discovery have persistently declined to reveal the locality where the bodies were discovered. They are in hopes of finding more Indian mummies, and of turning the discovery to pecuniary gain, either by selling the bodies or by exhibiting them and charging admission. They propose to make a thorough search.

The recent discovery of these mummies has attracted much attention among those who are interested in ethnology. The shape of the heads and other peculiarities leave no possible doubt that the bodies are those of Indians.

A New Satellite of Saturn.

A new satellite of the planet Saturn has been discovered by Prof. William H. Pickering, at the Harvard College Observatory. This satellite is three and a half times as distant from Saturn as Iapetus, the outermost satellite hitherto known. The period is about seventeen months and the magnitude fifteen and a half. The satellite appears upon four plates, taken at the Arequipa Station, with the Bruce photographic telescope.

The last discovery among the satellites of Saturn was made half a century ago, in September, 1848, by Prof. George P. Bond, at that time director of the Harvard College Observatory.

Sampson's Sword.

The special committee having in charge the selection of a design for a sword to be presented to Rear-Admiral Sampson have at last agreed upon that submitted by Simons Brothers, of Philadelphia, and its cost will be $2,000. The design represents on the head of the pommel the coat of arms of the State of New Jersey, while on the collar of the pommel will be raised letters and enameled flags crossed, being the emblems of the rank of Captain and of Rear-Admiral, signifying the fact that at the beginning of the war Sampson was a Captain and a Rear-Admiral at its close. The grip will be made of shark's skin wrapped with gold wire with forty-eight stars, each star being set with a diamond. The guard, top, and bottom will terminate with dolphins' heads with ruby eyes, the ruby being the natal stone of the Rear-Admiral. The sleeves of the scabbard are to be of gold and the rings are municipal fasces held to the sleeve by ship's cables. The monogram will be made of diamonds. The belt will be etched, showing the position of the American fleet in front of Santiago.

Passenger fare on the new Congo railroad is 33¼ cents per mile.

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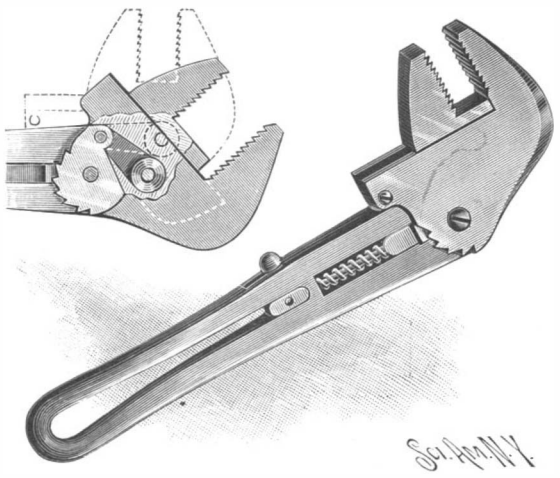
AN IMPROVEMENT IN WRENCHES.

The wrench which forms the subject of our engraving is provided with adjustable jaws which may be set to the nut merely by the movement of the wrench-handle, in contradistinction to being operated by the movement of a screw.

The handle of the wrench is formed with a slot in



KLATT AND BRODERICK'S IMPROVEMENT IN WRENCHES.

which moves a button attached to a sliding block. To the block a rod is secured which is surrounded by a coiled spring pressing against a double stop-pawl.

Pivoted on the end of the handle adjacent to the pawl is the main jaw of the wrench, on which the adjusting-jaw slides. On the main jaw, concentric with its pivot, segmental ratchets are formed which coact with the double pawl to hold the main jaw in the desired position. The adjusting-jaw is connected with the handle by means of links.

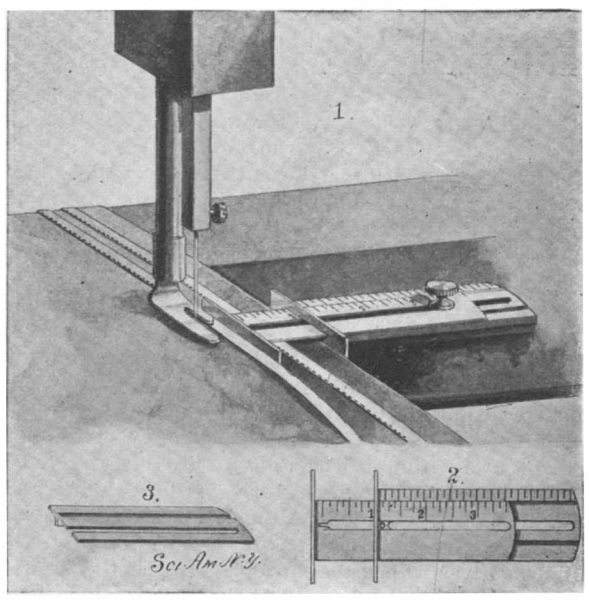
When the wrench has its parts in the position shown in the perspective view, the adjusting-jaw will be pushed by its links as near as possible to the main jaw; and the wrench will then be in position to grip the smallest sized nuts. When the wrench has its parts in the position shown in full lines in the partial sectional view, the jaws are opened to a larger capacity. In order to adjust the jaws to a nut, the wrench, when in the position shown in the sectional view, is placed on the nut and the handle turned toward the left, thus causing the adjusting-jaw to be thrown by its links toward the main jaw, and consequently closing both jaws on the nut. The spring-pressed pawl in bearing on the ratchets will hold the jaws in adjusted position. By drawing back the button sliding in the handle, the pawl may be drawn back to release the jaws.

The wrench has been patented by Reinhold Klatt and Thomas M. Broderick, of Strong City, Kansas.

A SEWING-MACHINE GAGE.

The sewing-machine gage which we illustrate herewith is a simple device designed to direct and locate trimming or braid upon a fabric.

Fig. 1 is a perspective view of the gage in operative



A NOVEL GAGE FOR SEWING-MACHINES.

position, showing the relation of the gage to the material to be guided and to the presser-foot of the machine. Fig. 2 is a plan view of the gage. Fig. 3 is a perspective view of a spacing strip or slide adapted to be used in connection with the device.

The gage consists of a base-plate and slide, both being graduated and having intermeshing ribs and slots controlling the direction of motion. The base plate is held in place on the machine by a clamping screw which is made to pass through a slot in the slide. Upon one end of the base-plate a head-plate, slotted to receive the slide, is formed, which head-plate serves to guide the outer edge of the trimming or braid. At its end, the slide is formed with a flanged guide-plate which is carried over the inner edge of the trimming.

In the operation of the device the base-plate and slide are first adjusted to their proper positions and are then clamped in place by means of the screw, the head and guide plates being in the positions previously mentioned.

When the material to be stitched is of such thickness as to prevent its passing under the slide, it is intended either to insert between the base-plate and slide, or to substitute for the slide one or more suitably ribbed and slotted auxiliary slides of the general character shown in Fig. 3, which insertion or substitution would permit the ready passage of the material.

The device is the invention of Miss Susan Chatfield, of 105 West Sixty-fourth Street, New York city.

The Volcano of the Paris Exposition.

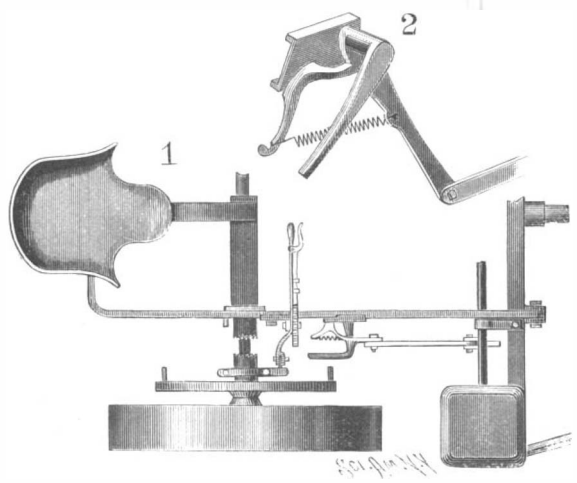
The Paris Exposition will abound in interesting novelties and concessions. One of the most curious will undoubtedly be the artificial volcano. We shall publish an elevation and section of the same in our SUPPLEMENT. It will be constructed at Grenelle, on the banks of the Seine. It will be 328 feet in height and 485 feet in diameter. From these figures it will be seen that the volcano will really be a mountain which visitors will have an opportunity of climbing. The sides of the mountain will be provided with shady roadways and footpaths, so as to make the trip to the top very agreeable. The framework of the volcano will require no less than 18,000,000 pounds of iron and steel for its construction. The earth which covers the framework will be real turf, in order that the mountain may present a verdant appearance. A roadway 25 feet in width will wind spirally up to a level of 240 feet, and will be decorated with climbing plants which here and there will form beautiful bowers, galleries, or simple arbors. At 120 feet from the bottom it will give access to a circular platform 30 feet wide and 1,000 feet in circumference. It will be called the "Alley of the Twentieth Century." At 240 feet the road will lead to another platform 30 feet in width, but only 328 feet in circumference. This will be named the "Franco-Russian Alley." Vegetation will be so arranged that visitors will pass from the splendid flora of the Mediterranean to the stunted shrubs found on craters. The paths will lead to the various restaurants, cafés, concert halls, etc. There will also be a reproduction of Dante's "Inferno." A cable railway will start from the base and will take passengers up to the Franco-Russian Alley. The summit will always be surmounted by a cloud of smoke in the evening, three eruptions will take place at fixed hours, and visitors will be able to see an imitation lava flow which will doubtless prove very interesting.

The Eclipse of 1900.

The Eclipse Committee, with Mr. Simon Newcomb as chairman, is now gathering information regarding the intended observation of the total eclipse of the sun which will occur in 1900, along the line reaching northeast from New Orleans to Norfolk, and thence across the Atlantic to Spain and Algeria. The totality is but brief in duration; still it is expected that many observers will take part, although fewer observations can be made than if a longer duration were available. Observers will, says The Nation, probably prefer the stations east of the Alleghenies, as to the west of those mountains the duration will range from 1 minute 30 seconds, near the mountains, to 1 minute 13 seconds, near New Orleans, where the sun will be much nearer the eastern horizon. The circular of the committee invites the co-operation of astronomers generally as to the measures to be taken.

A DROP-ACTUATING MECHANISM FOR SEED-PLANTERS.

A simple device has been invented by Peter W. Jeppesen, of Bloomfield, Neb., which is designed to operate automatically the dropping mechanism of corn-planters and similar agricultural machines, by the rotation of the wheels which carry the planter. Of our illustrations, Fig. 1 is a top plan view of one side of a corn-planter, showing the mechanism attached to the machine, and Fig. 2 is a perspective view of a bell-crank lever used to actuate the drop mechanism. On the planter-axle a wheel is mounted, which is provided with removable pins, upon the number of which the frequency of the seed-drop depends. This actuating-wheel may be mounted to turn with the axle; or it may be loosely held and rotated whenever desired by means of a clutch. In either construction the actuating wheel is grooved to receive a ring connected by a link with an operating-lever in reach of the driver's hand. The operating-lever is directly pivoted to a block bolted on the planter-frame—a construction which readily adapts the parts to most machines. The block has an arm terminating in a notched segment, capable of being engaged by a catch mounted on the operating-lever and controlled by a handle in the usual manner. By means of this arrangement the actuating-wheel may be shifted in and out of operative position. Mounted upon the frame is a bell-crank lever (Fig. 2). One arm of the bell-crank is held in the path of the pins on the actuating-wheel; and the other arm is connected with the oscillating or reciprocating bar of the drop mechanism. When one of the pins on the actuating-wheel engages the arm of the bell-crank, the other arm will be caused to operate the seed-drop. To return the bell-crank to its operative position after having been thrown aside by a pin, a coiled spring is used as shown in Fig. 2. The seed-dropping mechanism may be of any desired form, the particular type employed not materially affecting the general construction of the actuating parts. The devices described may be attached to any planter already constructed; they are simple in form, are readily controlled by the



JEPPESEN'S DROP-ACTUATING MECHANISM FOR SEED-PLANTERS.

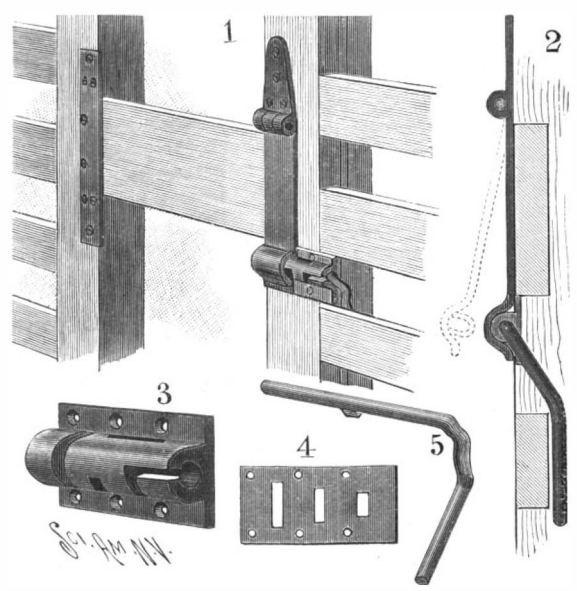
driver, and are adjustable to permit a regular dropping of the seed at any desired interval.

AN EFFICIENT FASTENER FOR STOCK-CARS.

The invention illustrated in the annexed engraving is a fastener for stock-cars, by means of which the entrance for the cattle may be effectively closed. The fastener consists particularly of an improved bolt and keeper for holding the hasp which confines the usual cattle-barrier or "bull-bar," as it is technically termed.

Fig. 1 shows the fastener in use. Fig. 2 is an elevation of the hasp and keeper, with the bull-bar in section. Fig. 3 is a perspective view of the keeper. Fig. 4 is a rear view of the keeper. Fig. 5 is a perspective view of the locking-bolt. The bull-bar, as illustrated in Fig. 1, is received at one end by a socket formed in a plate carried by one stanchion, and is removably held at the other end by a hasp on the other stanchion, the hasp being bent to conform with the shape of the keeper, as shown in Fig. 2.

Referring to Figs. 3 and 4, it will be observed that the keeper comprises a base formed with a tubular portion. The base and tubular portion are provided with longitudinal and transverse slots communicating with the bore of the tubular portion and with a gap adapted to receive a staple on the hasp. The bolt, which coacts with the keeper to lock the bull-bar, consists of a main part and of a handle, by means of which it is operated. The main part slides and turns in the bore of the tubular part of the keeper, the end of the part serving to cross the gap in the tubular portion, to hold the staple. A lug is formed on the main part of the bolt, and is capable of being worked through the irregular passage formed by the longitudinal and transverse slots of the keeper in order to lock and release the bolt. The peculiar forms



PEARSON'S FASTENER FOR STOCK-CARS.

of the keeper and of the bolt render it impossible for the bull-bar to become accidentally unlocked after the bolt has been once turned and shifted in place. The fastener has been patented by the inventor, Mr. John C. Pearson, Pocatello, Idaho.

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SOME NOTABLE GERMAN ARCH BRIDGES.

During the past few years German engineers have shown great activity in the matter of bridge construction, and some of the longest and, architecturally considered, most beautiful bridges in the world have recently been erected in various parts of the German empire. The particular form adopted has been that of the arch, a type which lends itself admirably to successful architectural treatment, and it is needless to say that a people so instinct with true æsthetic perception as the Germans were certain to produce results that would be very gratifying to the eye of the critic. At the same time these great bridges are characterized by ample strength and rigidity—features which are closely associated with the short panel lengths and riveted connections which are a characteristic of most German bridge work.

We have prepared a list of the fourteen longest steel arch bridges in the world, from which it will be seen that, while the longest arch is located in this country, the Germans have recently constructed the second and third longest, while three other of their bridges are to be counted among the first eleven big arches of the world.

Name and Location of Bridge.	Span in Feet.
Niagara, U. S. A	867·8
Rhine bridge, Bonn, Germany	613·3
Rhine bridge, Dusseldorf, Germany	594·5
Luis I., Oporto, Portugal	564·0
Mungsten, Germany	557·6
Grand Trunk, Niagara, U. S. A	550·2
Garabit, France	541·2
Levensau, Germany	535·9
Pia Maria, Portugal	524·8
St. Louis, U. S. A	520·2
Grunenthal, Germany	511·7
Washington, New York	510·0
Paderno, Italy	492·0
Rochester Driving Park	423·0

The longest span is that recently opened across the Niagara River to replace the wrecked suspension bridge. It has a length of 868 feet and is over thirty per cent longer than any other arch in existence.

The next largest arch is the Rhine bridge at Bonn, Germany, which consists of two shore spans of 133 feet and a great central arch of 613·3 feet span. The roadway is carried above the shore spans, and is suspended from the panel-points of the main arch. The shore abutments and the river piers are treated with careful attention to architectural effect, and the whole design is remarkably well balanced and appropriate. Illustrations and a more detailed description of the bridge will be found in the Scientific American Supplement of March 11, 1899.

The two-arch bridge over the Rhine at Düsseldorf, illustrated in the Supplement of February 11, 1899, is a larger structure than that at Bonn, although neither of the spans is as long as the single large span of the former bridge. They are 594·5 feet in length and of practically the same construction as at Bonn, consisting of two arched trusses with a roadway suspended from the panel points. The upper and lower chords of each truss are not parallel with each other, the trusses being considerably shallower at the crown than at the ends, and the deepening at the piers harmonizes well with the massive character of the piers themselves. These bridges were designed and built by Prof. Reinhold Krohn, who is well known in the foremost engineering circles of this and the old country. Arches of this type have been very favorably received in Germany, as witness the bridges across the Rhine, at Worms, and across the Elbe, at Harburg. The rapidity with which open hearth steel has taken the place of wrought iron in German bridge construction is largely due to the influence and labors of Prof. Krohn.

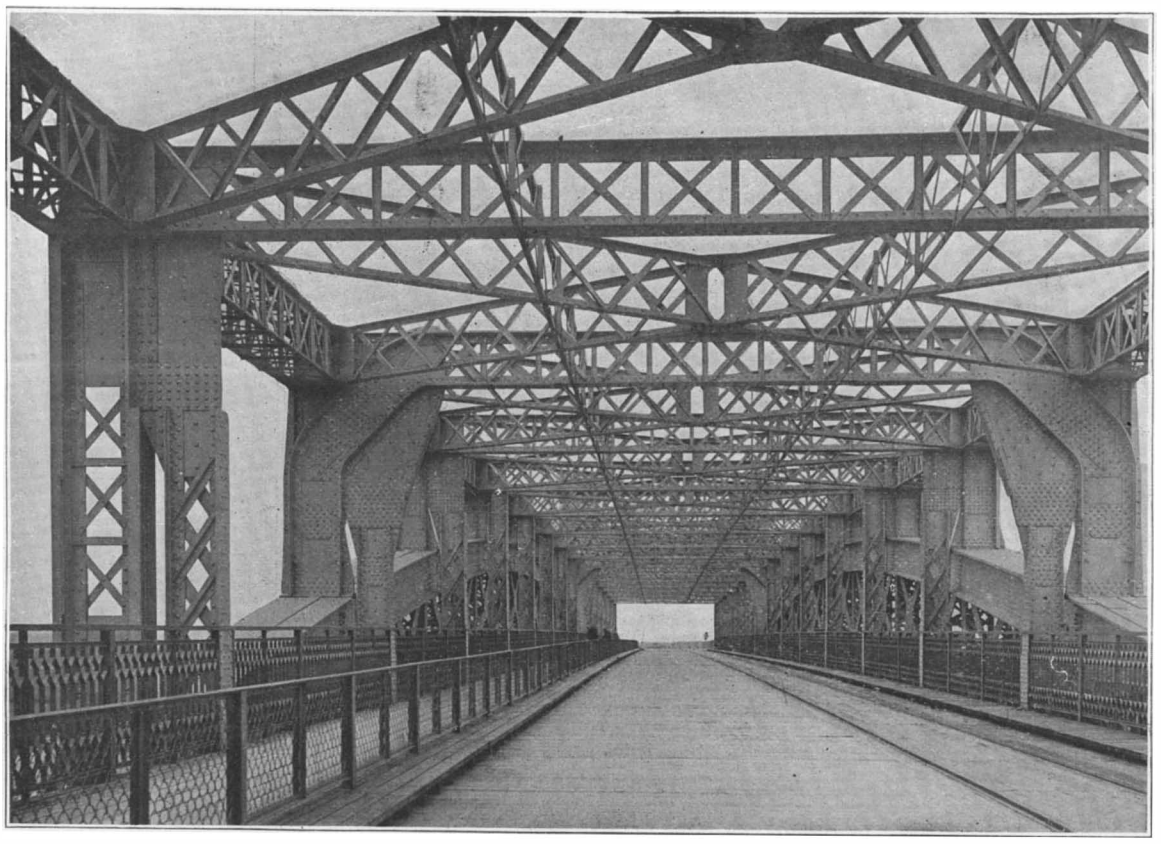
Our illustrations, for which we are indebted to Fritz Müller von der Werra, C.E., of this city, show two other notable arch bridges of recent construction; both of which span the Kiel Canal, one at Levensau and the other at Grunenthal. The Levensau bridge, which consists of a single graceful arch of 536 feet, was designed by the same Prof. Krohn who was responsible for the Bonn and Düsseldorf bridges. The canal at this point, it will be seen, is curved, and to compensate for the curvature (which has a radius of 3,280 feet) and allow ample room for shipping to navigate the turn, the canal is increased in width by 46 feet. The floor of the bridge is designed to accommodate both wagon, street car, and foot passenger travel. The clear width of the wagon road is 27 feet and the clear width of each footpath is 6·5 feet, while the width from handrail to handrail is 33·5 feet. It will be seen that the arches intersect the roadway, dividing the latter into three approximately equal portions.

The most noticeable and original feature of the design is the method of providing for the wind strains and of supporting the roadway. Instead of placing the wind bracing in the floor of the bridge, and supporting the floor directly, by means of vertical supports upon the upper chords of the arches, Prof. Krohn has provided a strong, lateral, overhead truss, which extends from abutment to abutment. Vertical posts extend from this truss to the arch beneath at each panel point, and instead of the floor beams being riveted at their ends to these posts, as would be done in American practice, they are hung, by means of heavy gussets from the panel points of the lateral wind truss, by means of web plates, which are riveted to both the struts of the wind truss and the tops of the vertical posts above mentioned.

To American eyes, this looks like a rather costly and indirect method of construction, and we must confess that the ordinary method of supporting the roadway, as carried out in the Grunenthal bridge, appears to be more satisfactory. We presume, however, that Prof. Krohn wished to avoid the bending strains which would be induced in the vertical posts if the floor beams had been riveted to them in the usual manner. In that portion of the arches below the floor the swaybracing is worked in between the arch trusses and the vertical posts, but in that portion of the arches above the floor the windbracing takes the form of massive plate knee-braces, which may be clearly seen in the view looking through the bridge on the roadway.

The Grunenthal bridge is a particularly graceful arch of crescent form, with a span of 511·7 feet. Unlike the arch trusses of the Levensau bridge, which are vertical, those of the Grunenthal arch have a batter toward each other. The floor provides for a wagon road and two foot paths, the roadway, 21·3 feet in width, being in the center between the arch trusses and the foot paths on the outside of them. The total width of the bridge is 43·4 feet and the height of the roadway above the canal is 137·7 feet. At the center the trusses have a depth of 13·44 feet, and they taper toward the skew backs, where they round in to a depth of 3·8 feet. The upper chord of each truss has a radius of 492 feet, the lower chord a radius of 442·8 feet.

As in the Levensau bridge, the roadway intersects the arches. The lateral bracing is carried in the lower chord of the arch as far as the point of intersection with the roadway, when it is continued in the roadway. Swaybracing is placed between the trusses where they rise sufficiently above the roadway to permit it. Windbracing is also worked in the roadway between the point of its intersection with the arch and the piers.



ROADWAY AND OVERHEAD WIND TRUSS OF THE LEVENSAU BRIDGE.

A Russian Railway Agency in the United States.

According to press dispatches from St. Petersburg, it is stated that in view of the extent to which American manufacturers are now supplying railway material to Russia, that government will establish an agency in New York for the purpose of issuing and registering contracts. It is possible that sub-agencies may be established at either Chicago or Philadelphia.

Magazines for the Navy.

More than $1,000,000 will be shortly expended for the construction of the magazines and factories where the high explosives and ammunition used in the navy are to be manufactured and stored. A Board of Officers was appointed to view the sites submitted. Now that funds are available, no time will be lost in securing the necessary land and beginning the erection of buildings. One of the new magazines will be built on the Palisades, near Edgewater, almost opposite Grant's tomb, on the Hudson River. It will have a frontage of several hundred feet on the Hudson River, and will extend to the cliffs. The buildings will be erected in a secluded place, away from factories and other structures. Now the Navy Department has one small magazine near New York. This is at Fort Lafayette, at the Narrows It is not only a very exposed position, but it is also too small for the purpose and is under the jurisdiction of the Army authorities, which is another reason why the Navy Department should have their own magazines. New York is the chief distributing point, and most of the ammunition during the late war was sent to the ships from there. Ammunition is extremely expensive to transport and handle, owing to its weight and its explosive nature; so that all possible economy should be effected in handling it.

The new magazine and factory in New York will be a great improvement over those now owned by the United States. Buildings will be erected for the storing of ammunition, as well as a laboratory for testing materials for guns and torpedoes. There will also be a building used for experimental work and a large plant for the manufacture of all kinds of powder. The buildings will be of solid construction, iron, steel, and stone being used. Several piers will also be built and the river is to be dredged at this point, so that large battleships can tie up at the piers and ammunition can be taken directly from the storehouses and placed in the magazines of the vessels. This will entirely do away with the expense and delay of handling charged shells. It will also avert the dangers surrounding reshipment. According to The New York Times, the plans will call for tracks to be laid from the storehouses to the wharves. Tracks will also connect with the several railroads whose terminals are in the vicinity of the plant. The buildings are to be equipped with the latest and most improved appliances. It is the intention of the engineers to make this plant the most complete of its kind in the world. When finished and ready for work, it is expected to be able to manufacture sufficient explosives for the entire navy and to have a capacity for assembling nearly all the fixed ammunition and charged shells needed. An Ordnance Officer says: "The war told us our needs and proved that the government should own its own plants, and New York is the place where the largest and best magazines should be built." When asked whether there would be any danger to the surrounding country, the officer said: "We have handled many thousand tons of explosives during the past thirty years, and have not in that time had any accidents." The plant will be away from towns and in the most secluded place. There will be no factories or other dangerous buildings near, and the buildings to be constructed will be as nearly fireproof as possible. The plant on the Hudson River will cost about $600,000. It is expected that work will be begun within the next few months.

Another plant, which will be somewhat smaller, is to be erected at the Naval Proving Ground, Indian Head, a few miles below Washington. The main feature of this plant will be the factory for the manufacture of explosives, the greater part of which will be smokeless powder. Like the plant to be erected at New York, all modern machinery and appliances will be used, and as far as possible, power and heat will be obtained by means of electricity. This plant will cost about $400,000, and it is expected it will be completed January 1, 1900. More than $100,000 has been expended for new machinery and instruments that were used in handling ammunition in the magazines at Fort Lafayette, and, so far as can be learned at present, it is the purpose of the Navy Department to continue to operate the plant in conjunction with the others.

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Correspondence.

Sulphur Flies.

To the Editor of the SCIENTIFIC AMERICAN:

The Mountain Copper Company, Limited, whose furnaces are six miles west of here, mine and roast from one thousand to twelve hundred tons of ore a day. The ore is composed of iron and copper sulphides carrying eight per cent copper and forty-four per cent sulphur besides gold and silver values. This ore is brought from the mine on the railroad and dumped in piles fourteen feet wide, six feet high, and two hundred feet long, sufficient wood to start it burning being placed in the bottom. It is then fired and left to burn for thirty days, when the roasted product goes to the blast furnace for smelting into matte. During the roasting process the sulphurous acid fumes evolved are so dense that respiration is almost impossible in their vicinity, and a coating of sulphur two inches thick is often formed on the outside of the heaps. After the heaps have been fired and the roasting well under way, there is a species of fly about the size of a large horse fly, having a gray body and a proboscis identical with the horse fly, that takes up his abode in these steaming, smoking heaps, and apparently lives and breeds in them. The lower portions of the heaps fairly swarm with them, and at night the workmen are compelled to wear netting over their faces, and gloves to resist their attacks, their bites being quite poisonous. For the want of a better name, the miners will call them sulphur flies. They seem to thrive in the densest fumes which are irrespirable to a human being. Is any such insect known to any other locality? They were never known here until the smelting operations commenced some three years ago. GEORGE A. FITCH.

Redding, Cal.

[We asked the opinion of Dr. L. O. Howard, Entomologist of the United States Department of Agriculture, in regard to this matter, who states that the occurrence is very unusual and that he had never heard of anything of the kind. He intends to investigate the matter.—ED. S. A.]

The Economy of High Pressure Steam.

To the Editor of the SCIENTIFIC AMERICAN:

The economy of steam at high pressure is dependent upon the fact that the total heat of steam generated at high pressure is but little more than that of steam generated at low pressure. It is worthy of note that James Watt partly understood this property of steam. He, however, was wrong in believing that the total heat necessary to change water at zero temperature to steam at any temperature was constant. The total heat of steam increases with the pressure, but not so rapidly as that pressure, nor does it even bear a constant ratio to it. It is evident, from what has been said, that any increase in pressure will not be accompanied by as rapid an increase in number of heat units; hence the economy of high pressure.

A few examples will bring this out more clearly. If a pound of water at 70° F. be converted into steam at 50 lb. pressure, a certain amount of heat is necessary to effect this change. Now, 1 lb. of steam at 100 lb. pressure could do considerably more work than the same weight of steam at 50 lb. could do, but an examination of formulæ shows that the total heat of the steam at 100 lb. pressure is but little more than that of the steam at 50 lb. pressure.

Let us now insert these pressures in the formula showing the temperature of steam at different pressures:

$$t = \frac{2938{\cdot}16}{6{\cdot}199 - \log p} - 371{\cdot}85$$

in which t = temperature of the steam in degrees F. and p = pressure in pounds.

Logarithm 50 = 1·699 and 100 = 2·000. Solving, we find the temperature to be 281·07° at 50 lb. pressure and 327·86° at 100 lb. pressure.

Let us now put these values in the formula for the determination of the total heat of steam at different temperatures:

$$H = 1091{\cdot}7 + 0{\cdot}305\,(t - 32°)$$

in which H = number of heat units and t = temperature of steam in degrees F.

Solving, we find total heat of steam at 281° to be 1166·4 heat units, and at 328° to be 1180·5 heat units; but, as we started with water of 70° F., in one case we have used 1166·4 — 70 = 1096·4 heat units, and in the other 1180·5 — 70 = 1110·5 heat units.

Hence the extra 50 lb. pressure only required 1110·5 — 1096·4 = 14·1 extra units. HARRY STRATTON.

Tiffin, O.

IT may not be well known that there are a number of aeronautical journals published. L'Aeronaute and La France Aerienne are both published in Paris. The Zeitschrift für Luftschiffahrt is published at Berlin, and the Illustrirte Aeronautische Mittheilungen at Strasburg. The Aeronautical Journal is published by the Aeronautical Society of Great Britain, at London.

Miscellaneous Notes and Receipts.

In order to tone silver pictures deep black, the following receipt is very useful, owing to its simplicity and reliability. Dissolve 1 gramme of gold chloride, 1·5 gramme of uranic nitrate and 15 grammes of borax in 2,000 grammes of water. After being toned, the pictures must be specially fixed, since a durable toning-fixing bath cannot be produced when using the above chemicals.—Technische Berichte.

A new style of shoes has appeared of late. The connection between soles and uppers is not effected in the customary manner, but both are screwed together in such a manner that the screw-heads are in the interior, while the screw-ends become riveted by wearing the shoes, so that an undesigned loosening of the sole is impossible, while the simplest connection imaginable of sole and vamp is thus created.—Technische Berichte.

To Dye Billiard Balls Red.—As soon as the ivory ball is finished it is laid in a vessel and covered with water. For one billiard ball the admixture of two teaspoonfuls of vinegar and one gramme of aniline red is sufficient. For a deep red take coralline, for amaranth use eosine, for crimson fuchsine is employed. When the ball has the desired shade, it is rinsed off with clear water and, after drying, polished with soap and Vienna lime.—Deutsche Tischler Zeitung.

The Cracking of Crucibles.—The cause of the frequent cracking of crucibles may be traced to the fact that the walls contain moisture. With quick heating the same is transformed into steam, which cannot escape quickly enough, and, in consequence of overheating, takes on a tension, which finally the walls of the crucible can no longer resist, thus causing the cracking at the largest diameter. In order to guard against this evil, it is advisable to heat the crucible slowly before use, so that the moisture held in its walls can evaporate. This previous heating should be done, even if the crucible is well dried out, not having been used for melting, but kept in damp and cold rooms.—Die Edelmetall Industrie.

A New Use for Electric Vehicles.—A case was reported recently of a clever application of the electric storage battery of an automobile described as follows: A woman had received a complicated fracture of her arm, too complex for the physician to accurately locate. He then decided to make use of a Roentgen ray apparatus for this purpose, but found the patient too weak to be removed. He obtained the apparatus, but, having no source of electricity convenient to operate it, called an electric cab by telephone. The current from the battery in the cab was conducted to the apparatus by special wires which successfully operated it and enabled the physician by the usual observations to locate the fracture in the arm and set the latter quickly.

It is said improvements are to be introduced in these vehicles whereby they can be made immediately serviceable to doctors in emergency cases.

Lacquers and Varnishes.—A good, cheap priming varnish for furniture consists of shellac 60 grammes, Burgundy pitch (white resin) 60 grammes, and ⅛ good rectified alcohol. With this mixture the article is treated in a warm, dry room. A good black ground can be produced by grinding fine ivory black with a sufficient quantity of spirit shellac varnish in a stone dish, using a pestle, until a perfectly fine black varnish is produced. In order to obtain other shades, the light varnish is mixed and ground with a quantity of a suitable pigment, such as vermilion or Indian red for red; chrome green or Prussian blue and chrome yellow for green; Prussian blue, ultramarine, or indigo for blue; chrome yellow for yellow, etc. Black is the color mostly employed; the following recipes being productive of a nice black ground:

1. Asphaltum, 1 part; copaiva balsam, 2 parts; and oil of turpentine as required. The asphalt is melted over the fire and mixed with the balsam, which has previously been separately heated; then take the whole from the fire and mix with oil of turpentine.

2. Moisten good lamp black with oil of turpentine, grind both together in a fine mortar, add a sufficient quantity of ordinary copal varnish and grind it all thoroughly.

3. Asphaltum, 90 grammes; oil varnish, 4½ liters; burnt umber, 120 grammes; and oil of turpentine as required. Melt the asphalt, stir it into the oil varnish, which has likewise been heated, add the umber and gradually the oil of turpentine. The following formula is said to produce an especially fine black appearance: Amber, 360 grammes; purified asphalt, 60 grammes; oil varnish, 0·1 liter; resin, 60 grammes; oil of turpentine, 480 grammes. Umber, asphalt and resin are carefully melted together, then the hot oil is added and all is again stirred up carefully and mixed with oil of turpentine after cooling. White priming varnish is prepared from copal varnish and zinc white or starch flour. The number of varnish coatings varies from 1 to 6 or more, but each layer must be perfectly hard before the next one is put on. The last coat, as a rule, consists of pale varnish without pigment and for valuable articles is subsequently polished with soft leather and tripoli, while for ordinary goods the gloss obtained in the enamel oven is sufficient.—Polytechnisches Notizblatt.

Science Notes.

The sewers of Paris are now being searched for treasures, owing to the recent discovery by workmen of a bundle containing $120,000 in securities.

"The latest American idea for the sheathing of vessels to prevent fouling and corrosion is to sheath them with glass plates, which is said to be entirely feasible." The above item is from The Engineer, of London. While this may be true, we have heard nothing about it, and it sounds suspiciously like paper bicycles and other things of like order, which seem to exist only in the minds of newspaper reporters.

The British Eastern Australasian and China Telegraph Company filed a claim with the State Department of the United States for $36,000 damages for cutting its cable by Admiral Dewey at Manila last May. The United States Attorney-General has now rendered a decision finding that, according to international law, there was no ground for a claim for indemnity where a military commander cuts a cable within the territorial waters of an enemy.

Petit Bleu, of Brussels, recently had a curious experience in which it was shown that no one is indispensable in this world. The compositors having struck, the text accompanying the illustrations was written out on the typewriter; then the typewritten sheets and the copy for the pictures were pasted on large sheets of cardboard and the whole was reduced by photography to the required size. From this negative a photo-engraving was made from which the paper was printed.

The authorities of the Southern Metropolitan Gas Company, an English corporation, have added workingmen directors to the board of the company. The report stated that the profit sharing system, which was introduced in 1889, continues to justify its existence, as it induces a generally intelligent interest in the welfare of the company on the part of its officers and men. Two of the workmen were elected by the workmen shareholders to sit on the board, and the result so far has proved very satisfactory.

According to The Medical Sentinel, it has been ascertained by careful observation that certain families in a village of St. Ourn, France, enjoy absolute immunity from tuberculosis. They are gardeners of excellent habits who intermarry among themselves and keep apart from the immigrant laborers. The latter suffer severely from the disease. It is considered probable that hygienic conditions are not the sole cause of the difference, but that by a kind of natural selection a race immune from tuberculosis has been developed.

Caisson disease, or compressed air disease, is a malady which is often contracted by those who are engaged in engineering work in positions where they are subjected to great air pressure. Dr. Thomas Oliver has observed several cases of this kind, and he has arrived at the conclusion that the symptoms are best explained by the theory that the malady is due to increased solution by the blood of the gases met with it in compressed air, and the liberation of these gases during decompression. The increased solution of the gases is due, of course, to the greater pressure upon the person of the caisson worker.

The old "Physic Garden," at Chelsea, which was leased to the "Apothecaries' Company" in 1673, and presented to them by Sir Hans Sloane in 1722, is to be placed under a Committee of Societies and the garden is to be maintained for promoting the study of botany with special regard to the requirements of general education, scientific instruction, and research in systematic botany, vegetable physiology, and instruction in pharmacy, as concerns the culture of medicinal plants. New offices, lecture rooms, and laboratories are to be provided. The old "Physic Garden" was one of the oldest, if not the oldest, botanical garden in the world, and is of considerable historical importance.

We were much surprised the other day in looking over the "R. I. B. A. Calendar," the official publication of the Royal Institute of British Architects, to find that a "water finder's" advertisement had been admitted into the annual of that conservative society. The fallacy of the divining rod has been demonstrated many times by scientists, but it appears to be not at all well understood in England. The advertisement goes on to say that, if anyone desires to have water discovered, "you cannot do better than engage the service of the well-known water finder, who undertakes to search for water for any parties required in any part of the country and to carry out the work, if desired, by special agreement. No water, no pay." The last few words are comforting, but, if we mistake not, a badly advised English municipality recently had to pay a considerable sum out of their pockets to an alleged water finder who found no water supply. Unfortunately, we believe that this decision has now been reversed on the flimsiest of technical grounds. The divining rod myth should be exploded by this time, and those who attempt to obtain money by its use should be severely punished.

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THE ELECTRIC CAB SERVICE OF NEW YORK CITY.

The success of the electric cab on the streets of our city is one of the most significant facts in matters of city transportation. After meeting the preliminary difficulties and discouragements which are inseparable from a new enterprise of this kind, the electric cab has taken its place as a popular means of travel. During the latter part of 1898 there were sixty-two cabs and broughams in commission, and there are now fully one hundred of these vehicles in service.

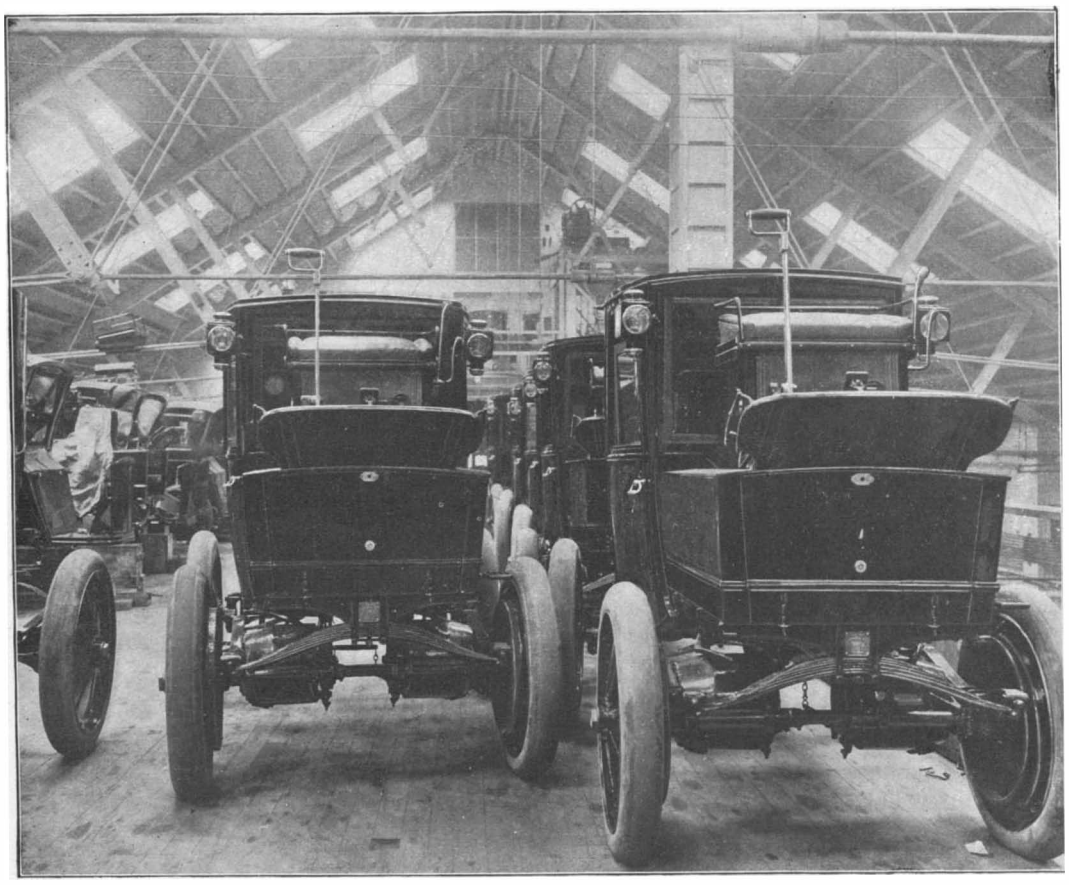
The central station, of which we show several illustrations, is located on Broadway, between Fifty-second and Fifty-third Streets, and it occupies a building formerly used as a bicycle academy, which has a frontage of 75 feet on each thoroughfare and is 200 feet in length, extending the full depth of the block. The Broadway front of the building is devoted to the offices of the company, the room for the drivers and the repair shop, while the rest of the floor is given up to the charging platforms, the battery room, and the storage of vehicles which are in reserve ready charged for use on the streets. The upper floor of the building is devoted to the storage of vehicles not in use and serves also as an erecting and repair shop. Elevators are provided for lifting the batteries and general material to this floor,

Before giving a description in detail of the general equipment of the station, it would be well to describe the construction of the cabs or broughams, several of which are shown in our various illustrations. In general appearance the body of the hansom cabs and the broughams resembles those of the standard variety, and the designers of the new vehicles have shown good judgment in endeavoring to make the new vehicles as inconspicuous and as familiar to the public as possible.

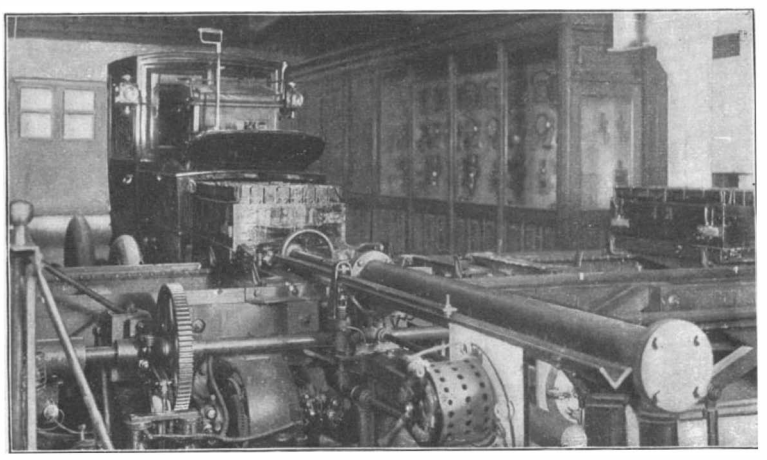
After considerable experiment with both kinds of tires, the company has decided in favor of 5-inch pneumatic tires in preference to solid tires 3 inches in diameter. The latest pattern of wheel consists of two ⅛-inch stamped and dished steel plates which are bolted to the hubs with their convex faces outward and converge toward the rims, thereby forming a hollow, disk-shaped wheel center. The diameter of the wheels is 36 inches; the tires are ordinarily pumped up to a pressure of 60 pounds to the square inch, although pressures as high as 100 and 150 pounds to the square inch have been tried experimentally.

The cabs are driven by two Westinghouse waterproof, ironclad motors capable of exerting four horse power combined. They are geared in a manner similar to that in use for railroad motors. Flexibility is obtained by interposing rubber cushions and springs between the frames and the motors. In the electric cabs, or hansoms, as they should properly be called, the driver is seated behind the carriage proper, and above a special compartment which serves to hold the battery. In the brougham, the battery compartment and the driver occupy the front of the vehicle. The steering is done by a steering-lever which has a motion forward and backward, while within easy reach of the driver are the controller switch and the reversing switch. The latter has an interlocking arrangement which prevents the motors from being reversed until the speed has been reduced to nothing. The controller provides for speeds of 6, 9, and 15 miles per hour, and the reversing switch, which is operated by the foot, is normally in the go-ahead position. There is also an emergency switch which shuts off the whole current on being kicked by the driver's foot. When this switch has been opened, it is in such a condition that no passerby can possibly turn on the current.

As we have already stated, the charging of the batteries and the reloading of the electric vehicles is done on the main floor of the building. The batteries have sufficient capacity to run the cabs for a distance of

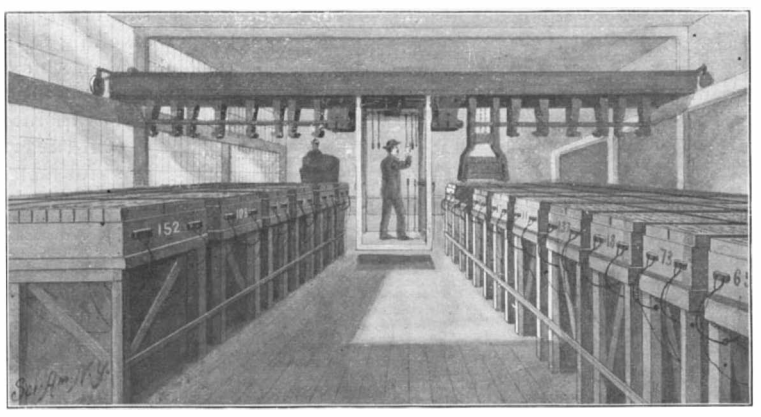


ELECTRIC BROUGHAMS IN THE STORAGE ROOM.



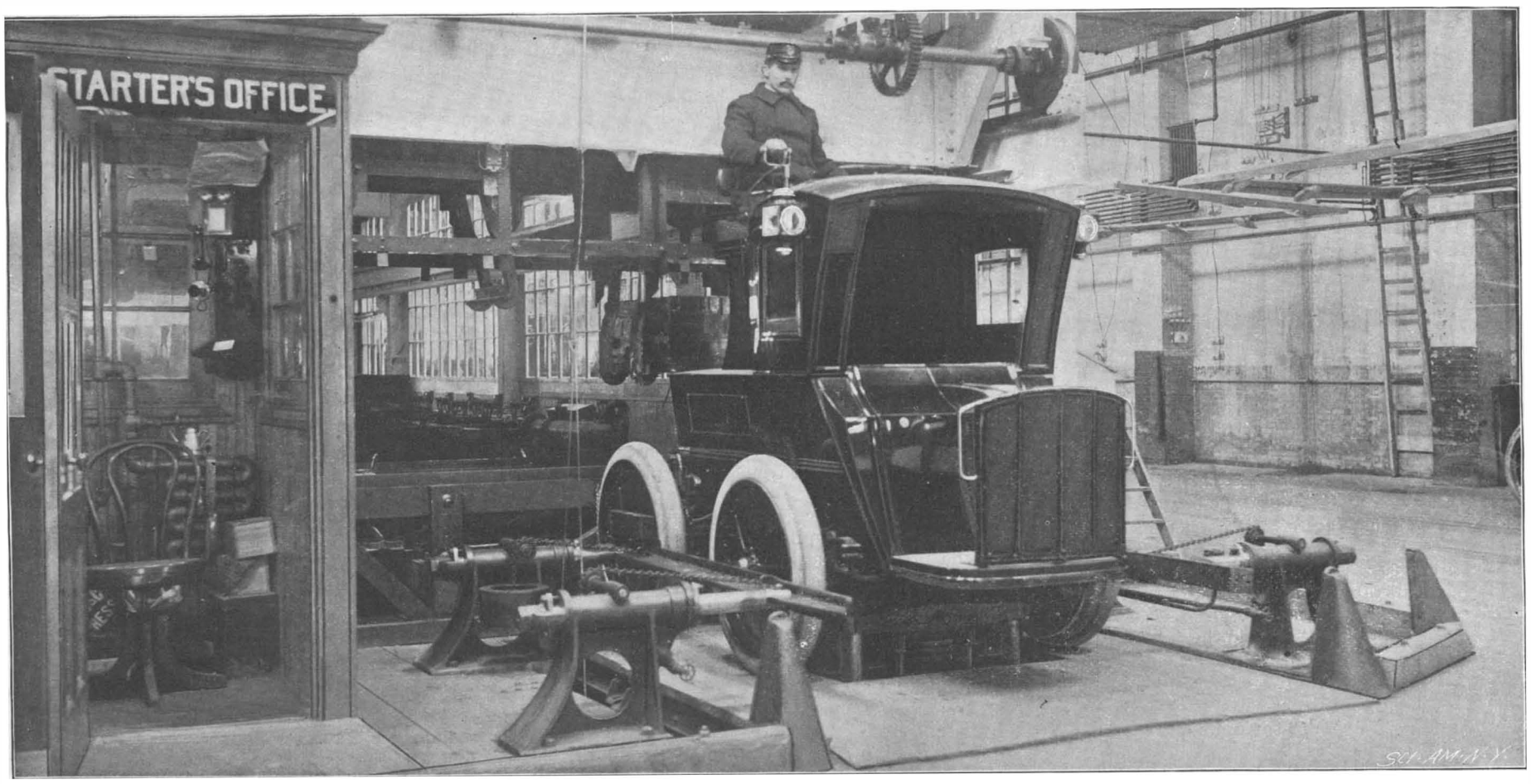
RELOADING AN ELECTRIC BROUGHAM.

Discharged battery has been withdrawn to table and carried to the right, and hydraulic ram is thrusting new battery into the brougham.



THE CHARGING TABLES.

Electric crane has just picked up a fresh battery.



THE ELECTRIC CAB SERVICE OF NEW YORK.

Charging Platform—Cab in position, electric crane bringing up fresh battery from the rear.

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from 25 to 30 miles, at the normal rate of speed of about 8 miles per hour. The vehicles are of two classes —those which are maintained continuously upon the streets and those which are kept at the station subject to calls. The former class returns to the station for charging before the batteries show signs of exhaustion, while the station cabs are recharged every time they return from service. Entrance is had to the charging-room by an entrance at the right-hand side of the Broadway front, and the cabs leave the station by means of another door at the left of the building. There are two charging platforms, with a starter's office located between them, as shown in our illustrations. The cab is backed onto platforms and adjusted upon them both laterally and vertically by means of hydraulic rams, which brings it into the correct position to receive a fresh battery. On each side of the charging platform is a lateral adjusting-bar, operated by a pair of horizontal hydraulic rams. The adjusting bars are of the same height as the hubs of the wheels. As soon as the cab has been backed on the platform, the bars move forward from opposite sides and align the cab with great accuracy opposite the loading table for the batteries. Other hydraulic rams beneath the platform raise the cab, so that the floor of the battery chamber in the cab shall be exactly on a level with the table. A hydraulic ram on the opposite side of the table now moves forward, and, by means of a grappling device, withdraws the discharged battery onto the table. The table consists of several sections, and it is capable of transverse movement across the battery room. After the empty battery has been deposited, the table moves transversely the width of one section, thereby removing the spent battery and bringing a charged battery in front of the cab. The hydraulic ram now moves forward and thrusts the battery into the cab, where it is automatically brought into contact with the wiring to the motors.

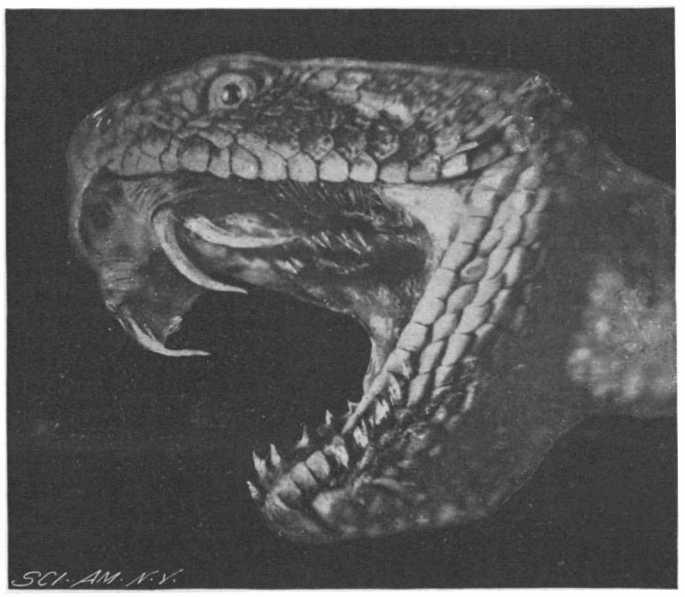
The charging of the batteries is done upon eight rows of tables which extend down the length of the charging room. The empty batteries are carried to these tables and the charged batteries are taken from them to the cabs by means of an overhead electric traveling crane. After the battery has been withdrawn from the cab to the transfer table (which is really an endless traveling link belt electrically operated) it is carried laterally by the table into line with the particular row of tables desired, when it is picked up by means of four hooks which are let down from the electric traveling crane, raised to the desired height, and then carried down the room by the crane and deposited in place. The operation is reversed in transferring the charged batteries to the cabs. The traveling crane is completely controlled in all its motions by an operators who stands in an operating cab suspended at the mid-length of the crane, and which travels with it throughout the full length of the room.

The electric cabs have proved to be particularly popular for certain classes of work. Physicians and all who have occasion to make hurried journeys are very frequent and constant patrons of the new service, while there are several of the cabs that are retained by business men who find it more convenient and even more expeditious to go "down town" by electric cab than by the other means of travel. The cabs, moreover, have proved in the recent snowstorms that they can keep going long after the horse-driven cabs have given up the attempt. We are indebted to Mr. G. H. Condict, the chief engineer of the company, for courtesies extended in the preparation of this article.

A WRITER in The Medical Age says that typhoid fever patients should not be filled up with milk, which is administered as liquid food; for, while it seems to have the form of liquid, yet, as a food, it is not liquid, but solid. The article states that bread and butter, mashed potatoes, or even pumpkin pie are not capable of filling the small intestines with such immense indigestible boluses of substance as result from milk. It is also a fine culture medium, and it is marvelous to see how rapidly bacteria are propagated in it.

A CURIOUS CASE OF ABNORMAL DEVELOPMENT IN A RATTLESNAKE.

The photograph which we present herewith was sent to us by Dr. R. Menger, of San Antonio, Tex., and is a lifelike representation of the head of the much dreaded rattlesnake, the Crotalus horridus. The original reptile was a very large rattlesnake and was killed by a friend of Dr. Menger in the hills of Helotes, about eighteen miles northwest of San Antonio. The rattles and the head of this snake were presented to him and he prepared the fangs, etc., to show their relation to the poison glands. The head was supplied with four fangs, two full grown and two others near them in the front region of the upper jaw. The exposure was taken by lamplight. The fact of the snake having four fangs is interesting. In all rattlesnakes there are, besides the poison fangs, rudimentary fangs which, upon the loss of the old fangs, develop and supply their place. In this case, however, the development has been abnormal, and the second pair of fangs have developed before any loss of the old fangs has been sustained.

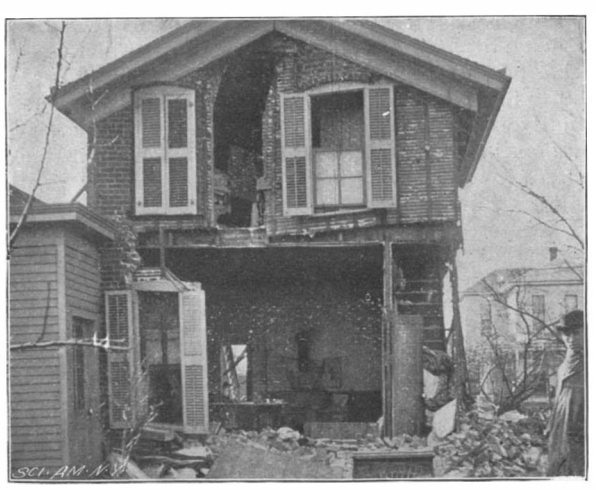


ABNORMAL DEVELOPMENT OF A RATTLESNAKE'S FANGS.

AN INTERESTING EXPLOSION OF GAS.

We have at different times referred to the danger of explosion caused by escaping gas, and we have rarely heard of a more complete ruin than that caused by an explosion of gas at Fort Wayne, Ind., on February 26, at the residence of Mrs. Mary Nichter, in which her son was severely injured, and the house was almost totally wrecked. The house was a two-story brick building with an ordinary cellar below the ground floor. A few days before the accident an inspector from the gas company made an examination of the premises and pronounced everything to be all right. It is believed that the frost coming out of the ground caused a break in the pipe, disabling the service connection and allowing the gas to escape into the cellar through a duct in the earth along the service pipe. The boy went down into the cellar, and, on reaching the bottom of the steps, struck a match with which to light a candle. Instantly there was a blinding flash, followed by a tremendous explosion. The cellar must have been almost entirely filled with escaping gas. With a splintering crash the kitchen floor was rent, the walls of the house were pushed outward, falling in heaps, and the interior of the house was instantly transformed into an almost total wreck. Mrs. Nichter and a younger son made their way painfully out of the ruins, and, throwing the outside cellar door open, the neighbors succeeded in rescuing her injured son, whose clothing was in flames. The lad was wrapped in an overcoat, extinguishing the flames, and it was found that he was severely burned, and he was removed to a hospital. The explosion set fire to the house, but the flames were promptly extinguished by the fire department. The houses in the neighborhood were shaken by the violence of the concussion; the south, west, and north walls of the ruined house from foundation to eaves were heaved outward, greater violence being manifested near the ground. The east wall was also destroyed, but does not appear to have been pushed outward with so much force. Bricks were projected through the shutters and glass of an adjoining house. Above the first floor the brick walls were torn off from the framework of lath and plaster. Portions of the walls were sustained by windows, and in some cases where the walls were destroyed the glass in the windows was not shattered. The main force of the explosion was upward. The carpets in the sitting room were ripped and raveled, furniture was demolished, and scarcely anything on the ground floor was spared destruction. On the second floor there was also considerable destruction. The roof was unsettled and had to be shored up by the firemen. A freak of the explosion occurred in the small pantry, where the dishes on the shelves were not disturbed, although the wall back of them was destroyed. This should be a lesson to all. In case a gas leak is discovered, if it is thought to be serious, all openings, such as doors and windows, should be utilized to permit of the escape of the gas. On no account should a light of any kind be taken into a room or building where the presence of gas is suspected. We are indebted to Mr. August Zagel, of Fort Wayne, for the photographs from which our engravings were made.

FRONT OF HOUSE WRECKED BY GAS EXPLOSION.



REAR OF HOUSE WRECKED BY GAS EXPLOSION.

The Berlin Geographical Congress.

The Geographical Congress which will be held in Berlin at the end of September will be particularly important, in view of the practical geographical work which the congress considers it desirable to undertake. Several subjects will be brought before it. It is proposed to introduce international uniformity in the methodical treatment of the various subjects, such as the problem of the tides, the conventional signs on maps, the nomenclature and delimitation of oceans and seas, the attachment of the scale to every map, the mode of arranging meteorological tables, etc. There are also suggestions for joint international work in collecting materials of every kind referring to floating ice, earthquakes, to the reclamation of arid lands, etc., to the exploration of the Antarctic regions, and to the execution of the international geographical bibliography. It is probable that a very important subject, which dates from the meeting at Berne, will be finally disposed of at Berlin. This is Prof. Penck's well-known project for the construction of a map of the world on the scale of 1 to 1,000,000. All papers and proposals to the Congress will be submitted to the Scientific Committee, whose decision, as a rule, will be final. This will tend to prevent the programme of the congress from being overcrowded. Propositions or suggestions should be presented in writing before June 1, 1899, and should fully discuss the motives, and should be accompanied by the statement of the ways and means which may appear likely to lead to the accomplishment of the scheme.

Saluting a Phonogram.

It will be remembered that Queen Victoria spoke a message of friendship and good will to the Emperor Menelek, of Abyssinia, after the recent victory in the Soudan. The message created a marked impression on his Majesty. The royal words were delivered on a Sunday, the phonograph working excellently. The tones of her Majesty's voice were reproduced with remarkable clearness, and Menelek was so pleased that nothing would satisfy him but to hear the message at least a dozen times. First he would listen to the words as they came from the trumpet of the phonograph, and then he would use the ear tubes. When his curiosity and delight had been satisfied, he relapsed into solemn silence, and ordered the royal salute and remained standing while seventeen guns were fired. Menelek himself has tried to send a message by the phonograph, so that he appreciates the difficulty of securing a satisfactory record.

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ANTIQUE CHAIN ARMOR IN THE CAUCASUS MOUNTAINS.

BY E. O. HOVEY.

The mountain defiles of the Caucasus ranges are so deep and so completely isolated from one another that the tribes which inhabit them have preserved their distinctive characteristics much more decidedly than most parts of the world which have felt the touch of European civilization. Some of these tribes boast of great antiquity and certain families have preserved for many generations ancestral heirlooms, such as armor and weapons, furniture and garments. The photograph herewith reproduced shows some men of the Pchaves, a Georgian tribe living at and near Ananoor, in the southern part of the mountains, on the Georgian military road, who donned their ancestral chain armor and gave an exhibition of ancient broadsword combats for the benefit of the members of the Caucasus excursion of the International Geological Congress last summer. The armor was made of small round links of iron or steel wire woven together to form a long-sleeved shirt or tunic which reached to the knees. The head was protected by a small round skull cap of steel or iron from which hung another piece of chain armor, coming down to the shoulders and breast. The shield was small and round, shaped like a bowl, with a point projecting from the center. The sword was long, double-edged, and so heavy that exercise with it soon exhausted the strength of the men giving the exhibition of their skill. Another antique weapon carried by these men was a musket with a barrel about six feet in length, the whole weapon being protected by a goatskin case. The others on each end, as shown in the picture, are Cossacks. These form the quasi-volunteer cavalry troops of southern Russia. They provide themselves with horses, uniforms, and weapons and serve as guards to the highways and perform certain other military duties, on demand of the governor of the district in which they live, in return for which service they are relieved from taxation to a certain extent. On the breast of the figure on the right will be seen the cartridge pouches. Their costumes are picturesque, and they have a worldwide reputation for the excellence and daring of their horsemanship.

COSSACK CAVALRY SOLDIERS AND THEIR ANTIQUE CHAIN ARMOR.

Some Badly Needed Inventions.

According to the authority of the grave digger in Hamlet, an act has three branches—to act, to do, to perform; and the same may be said of inventing—financially successful inventing, that is. It has three branches. The first is the idea conceived; the second, the idea achieved; and the third, and most important, the idea received, that is, selling on the market, says a writer in The London Standard. We might almost say that invention has four branches, the extra branch being knowing what to invent, and it is proposed here to deal more particularly with the fourth branch. The general idea that inventions in a small way are exhausted is erroneous, as is likewise the popular impression that inventions of the greater kind need technical knowledge. A man may make a fortune out of a useful penny article or out of an accidental discovery, and that without technical knowledge. No special knowledge of any kind was needed to invent the bent wire safety pin, the inventor of which is supposed to have made a fabulous fortune, nor could it be said that the invention of the anchor with flukes hinged at the middle required either genius or technical knowledge. The idea was the invention, the actual carrying out of it was practically nothing, and both ideas could as easily have occurred to a plowboy as to an Edison. The mud from our streets, some thousand of tons of which are scraped up daily, ought to be put to some use other than building suburban residences, for which it is not well-suited. In this case it is wanted to know what profitable use it can be put to, and once the idea is formulated, and is practicable and profitable, the detail is soon worked out. This is an invention badly needed, and would make a large fortune if it were discovered. There is another article which is wasted hugely, and that is wood. The present method of sawing lumber produces a large quantity of sawdust, only a very little of which is used. Every saw-cut wastes a plank the thickness of the saw and length and breadth of the log, whether the resulting planks be thick or thin, and the surface so left has in most cases to be planed, which wastes about half as much again as is wasted in sawdust. Now an invention is badly needed which will obviate this waste. The wood must be cut, not rasped through, so as to leave a clean surface, and waste nothing in dust or shavings.

Electricians badly need a perfect insulator. It must stand heat, cold, water, air, and all atmospheric conditions and be quite flexible, have great strength and electric resistance, and, above all, must be cheap. Rubber at present fulfills the bulk of these conditions, but it is worth some 15s. per pound. But then, on the other hand, worn-out rubber is an almost valueless commodity, as it cannot be made up again. This is due to the sulphur used in manufacturing the raw material. An inventor is wanted who can devise a cheap process of extracting the sulphur from the old wornout rubber and rendering it as serviceable as new. Probably an accident will show the method of doing this, and when it does it will be rash to invest in rubber companies. Ships, nowadays, are built so as to defy almost everything, save the carelessness of man. One or two things they lack, however. They need something which will effectually protect the parts under water from barnacles and other fouling pests of the sea, and that for an indefinite period. They need an invention which will warn a ship in a fog of the proximity of other ships, say within a distance of two miles. Not only that, but the warning must be in such a form that each ship will know the exact course that the other ship is steering, so that she can lay out her own accordingly. Of course this is practically a sea telegraph, and it is possible that the wireless telegraphy we have heard so much about recently may apply. The method in vogue among the drivers of expresses upon our big lines in the case of thick fog is to trust to the officials to keep the line clear and go ahead. So, at least, the writer has been told by one of them, and the fact that expresses mostly arrive punctually on foggy nights, or even before their time, would seem to support the assertion. Under existing circumstances, this possibly is the best that can be done, as fogs often make it impossible for drivers to see signals even when close beneath them. Still it cannot be denied that the practice is dangerous, and, consequently, as we are given to having fogs in this "nook shotten isle of Albion," it would be better if a system could be devised by which communication could be made with the driver direct upon the engine. In this it is not so much the communication to the driver to stop which is the difficulty—that can easily be done. But the problem is how to effect the communication to him to go on again. Something which will effectually do away with the smoke nuisance is badly needed, especially in such cities as London, Manchester, etc. Of course, smokeless coal has done away with much, but there is still room for an invention which will do away with the rest.

In the matter of town improvements, too, there is the much-felt need of a really good permanent roadway. Asphalt is good, when either wet or dry, but a sprinkling of rain makes it as greasy and slippery as ice. Wood blocks have the same objection and wear into holes too quickly, while granite sets are noisy, liable to settle, and do not give a very good foothold. The best roads for horses are, doubtless, the macadamized variety; but, unless they are relaid every other day or so, the city roads, where there is much traffic, would soon be as bad traveling as frozen plowed fields. What is wanted, therefore, is a road with the holding advantages of macadam, and the permanency of asphalt, and the silence of wood. It must be as cheap as any of them, and will therefore be made from the refuse of some manufacture or other which is practically worthless. We suggested above that worn-out rubber is useless and that the mud from our streets is useless. Could they be combined in some way so as to make a useful road? The lighting of our roads, too, needs much improvement. The arc lamp at present used is inefficient on account of its flickering—in fact, for many purposes arc lighting cannot be used, because of this fault, although it would be the very best light were it perfect. Therefore, invent a perfect arc lamp—O ye geniuses! Much as it is needed, there is no good preservative for iron and woodwork which is exposed to the atmosphere. Paint is but a makeshift, and a poor one at that, having to be constantly renewed, and the same may be said of all other preservatives save one—cement. We have seen pieces of iron which have been embedded in cement for centuries, dug out of the same, without the least suspicion of rust, and still retaining the bluish color of the forge. What is wanted is the application of this knowledge to air-exposed ironwork. Another kind of paint is needed for inside woodwork. It is one which will render the article to which it is applied uninflammable. Some of the salts of strontium would accomplish this, but they are two expensive at present. There is, therefore, another alternative, and that is to devise a way of obtaining the strontium salts more cheaply; and to make assurance double sure, houses should be built with a perfectly fireproof brick—a brick which can have a fierce fire built upon it and have its under surface quite cool, although only about an inch in thickness. Such a brick has been an existing fact, is now, but its inventor is dead, and he, and only he, knew what the ingredients of that brick were.

A Typewriter Wanted for the Blind.

Those who are interested in the welfare of the blind will be pleased to hear of a great improvement in the method of printing for the blind, devised by Dr. A. Mascaró, a Spanish medical man, long a resident in Lisbon, who has hit upon a very ingenious method which enables people who can see to read books prepared for the blind, or to correspond with them or to teach them to read without any previous training in the blind alphabet. This is accomplished by a modification of the Braille embossed alphabet, which consists of a grouping of dots in relief. Dr. Mascaró has succeeded in connecting these dots by means of dark lines, thus exhibiting the complete outline of each letter. This is done by printing on the reverse side of the porous paper, so that the type which produces the bosses can also lay on the ink, and this in its turn passes through the porous paper to the other side, making a distinct mark. Thus, the letter L is represented by four dots, three of the dots being in a vertical line and one at the right, while they are all connected by a fairly black line. This enables the person with eyesight to read easily while a blind person feels his way over the same surface. In practice it was found necessary to twist the visible lines somewhat out of shape, but the effect is perfectly plain and readable. Writing by hand is done with the aid of a guide with perforations, which also enables the connecting lines to appear on the lower surface of the paper, which lies against a sheet of carbon paper used for the purpose. The great desideratum is a typewriter for this work, and, in view of the fact that this instrument originated in America, in an attempt to help the blind (for we refer to the typewriter invented by the late Alfred Ely Beach), the Rev. Robert H. Moreton, of Oporto, Portugal, thinks it will not be strange if some one in the same part of the world does solve the problem, by producing a machine which will print embossed lines with carbon outlines complete. There would certainly be a field for a machine of this kind, though naturally the number of them which could be sold would be limited. Heretofore books which have been printed for the blind have been so expensive and bulky that their use has been limited. We have some examples of the Mascaró system, and we shall be glad to send a sample of the work to those interested in producing such a machine.

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THE GREAT TELESCOPE AT THE PARIS EXPOSITION OF 1900.

In a recent issue of the SCIENTIFIC AMERICAN (see SCIENTIFIC AMERICAN, March 11, 1899), Prof. Pickering, of Harvard University, advocated the establishment of a horizontal telescope of great focal length. He suggests a telescope with an aperture of 12 to 14 inches, having a focal length of 135 to 162 feet. The star would be reflected into the instrument by means of a mirror. It will be interesting to learn that a telescope of this general character is to be built for the Paris Exposition of 1900.

Our esteemed contemporary La Nature, in speaking of this announcement, says: The great telescope which is to figure at the Exposition of 1900, and which is due to the initiative of M. François Deloncle and the skill of M. P. Gautier, will surpass the most powerful instruments of the kind that have ever been constructed. The greatest telescope that exists at present is that of the Yerkes Observatory, the objective of which is 3·28 feet in diameter, and the focal distance about 65 feet. It moves around an axis fixed in the center and in a vast cupola 78 feet in diameter.

The telescope of 1900 has an objective of 4·1 feet in diameter and a focal distance of 65 feet, and its weight exceeds 44,000 pounds. It was therefore out of the question to think of placing the instrument under a cupola 209 feet in diameter, as this would have required foundations of exceptional solidity, the maneuvering would have been difficult, the flexions and distortions of the glasses and tubes would have been considerable, and the net cost would have been extremely high.

M. Gautier decided upon a very advantageous form, and one that, under the circumstances, was necessary —that of the Foucault siderostat (a heliostat regulated to sidereal time).

This instrument consists essentially of a movable plane mirror actuated by a clockwork that causes it to move in such a way that the luminous rays thrown upon it by a star are, after their reflection, sent in a fixed and absolutely invariable direction. If the axis of the telescope be placed in such direction, the observer, upon putting his eye to the eyepiece, will see the image constantly during the entire time in which the star remains above the horizon, and will be able to study it at his leisure, and to make drawings and photographs of it.

Fig. 1 shows the apparatus in its entirety. The siderostat is at the north, with the mirror placed upon the movable support. The declination circle is seen as well as the horary axis, resting upon a stone base. The ocular, with its movable part, is at the south.

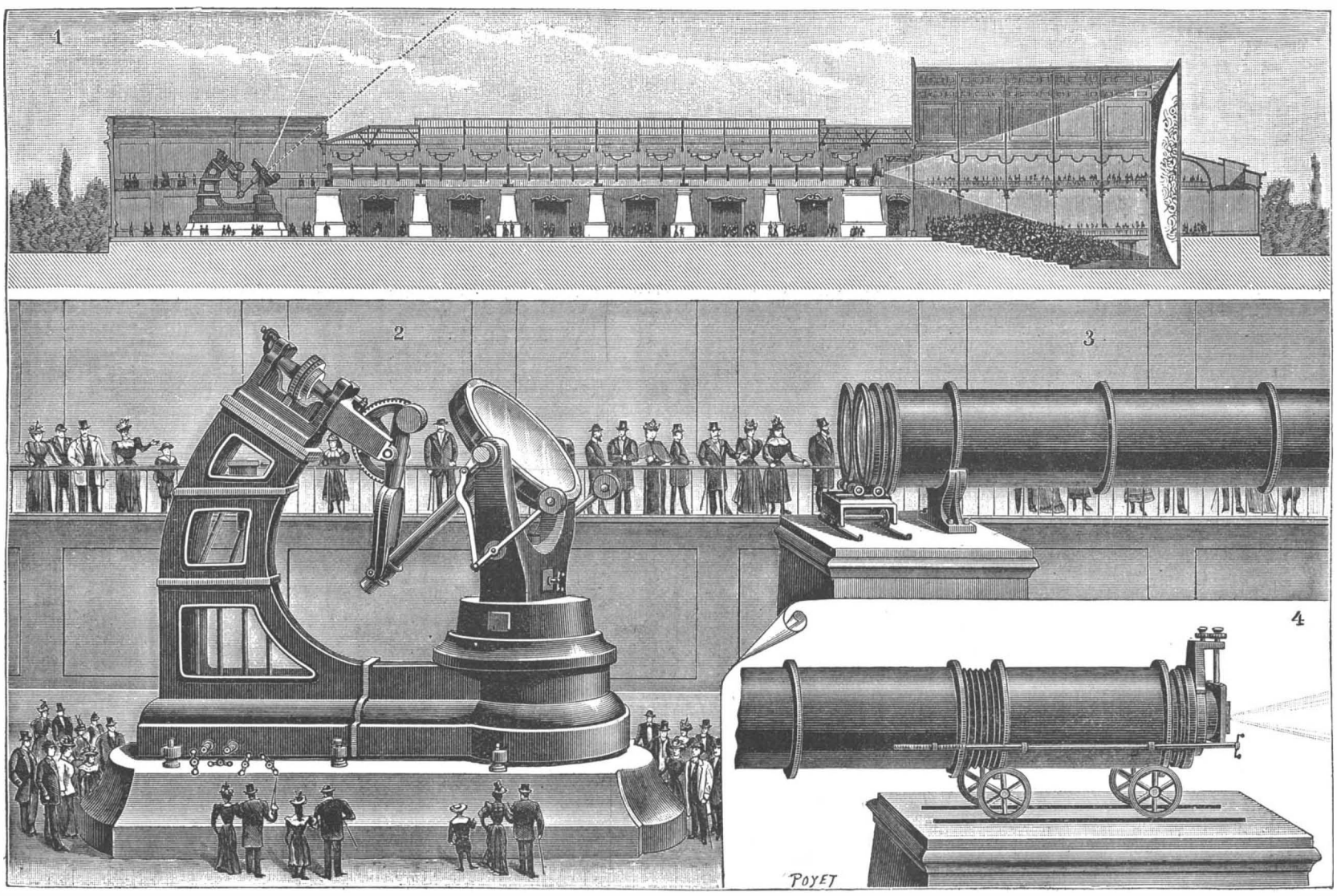
This magnificent instrument, when mounted, will be the optical and mechanical chef-d'œuvre of the nineteenth century.

The siderostat under consideration comprises a circular mirror 2 meters (6½ feet) in diameter, absolutely plane and giving excellent images, and of a 196 foot telescope placed horizontally in a line running north and south. The telescope forms the images to its focus, where they may be examined by means of an eyepiece, or be received upon a sensitized plate, or be projected upon a screen placed in a hall in which they will be exposed to the view of numerous spectators.

Let us now pass to the details. The mirror consists of a glass cylinder, 6½ feet in diameter and 10⅓ inches in thickness, and weighs 7,920 pounds. It is arranged in a 6,820 pound tube, and is kept in equilibrium through a system of levers and counterpoises.

All this part is fixed in a mounting of which the total weight is 33,000 pounds. The base of this mounting floats on mercury contained in a tank, and the thrust of which eases it of $\frac{9}{10}$ of its weight. Hence the clockwork that directs the apparatus has merely to displace a mass of 33,000 pounds, and its motive weight is but 220 pounds.

The siderostat (Fig. 2) comprises: (1) a cast iron base 34 feet in height, of which the southern part supports the horary axles, parallel with the line of the poles, and its toothed rings; (2) the declination circle; (3) the clockwork movement, connected with the circle and its weight; (4) the cranks which serve respectively for the tangent screw, for the displacements of the horary circle, for the declination circle, and for the winding up of the clockwork. The part situated at the south comprises: (1) the support of the mirror, mounted in the tube and resting upon the breech, with the screw that permits of displacing it; (2) the axis of direction of the mirror, which slides in a tube, fixed upon the diameter of the declination circle; (3) the counterpoise of the mirror; (4) the mercury reservoir; (5) the windlass, designed to raise the receptacle for the silvering mirror; (6) the rollers of the support; and finally (7) the regulating screws of the siderostat. Fig. 3 gives the arrangement of the objectives, 4·1 feet in diameter, one of which is designed for visual observations and the other for photographic work. They are mounted together upon the same carriage, the base of which rolls upon the rails by means of wheels, in such a manner that one or the other can be easily adapted to the extremity of the telescope which is in the vicinity of the siderostat. The tubes that carry the crown and flint glass lenses are mounted upon the rails. The flint and crown glasses may be separated from each other in order to permit of wiping off any dust that may settle upon them. Fig. 4 gives a lateral elevation of the ocular. Here it shows the external tube set in motion by the wheels, the internal tube sliding into it by the aid of the rollers, and the bellows that join the ocular with the body of the telescope. Clockwork movement carries along the tube through the transmission rod.



DETAILS OF THE GREAT TELESCOPE.

1. General view. 2. The siderostat. 3. The telescope. 4. The ocular.

The New York Academy of Sciences–1899 Reception.

The sixth annual reception and exhibition of the New York Academy of Sciences will be held on the 19th and 20th of April, in the American Museum of Natural History. There will be three sessions, as usual: That on Wednesday evening for members of Academy, exhibitors, and special guests; that on Thursday afternoon for teachers and students; and that on Thursday evening for the members of the Scientific Alliance and their friends. These annual receptions have come to be an important feature in the scientific life of the city, on its more popular side, and they are looked forward to with interest, because the exhibitions connected with them illustrate in the most graphic way the progress which has been made in the various departments during the year. The general committee of arrangements consists of Prof. H. F. Osborn, of Columbia University; Prof. C. A. Doremus, of the City College; Mr. C. F. Cox, of the New York Central Railroad; and Prof. C. L. Bristol, of the New York University. The chairman of the committee on exhibits is Prof. William Hallock, of Columbia.

The Current Supplement.

The current SUPPLEMENT, No. 1212, is of exceptional interest. The first article is on "Excavations in the Roman Forum," and deals largely with the recently discovered tomb of Romulus. "The Passy Underground Railroad" describes a great engineering work in Paris and supplements the work described last week. "Trade Suggestions from the United States Consuls" is continued and is the subject of thirteen notes. M. De Baye's "Mission to the Caucasus" describes an interesting exploration in a little known country. "Approved Lightning Protection" is an article by Nevil Monroe Hopkins and is a short treatise on the historic and modern lightning rod and its daily incorrect application; it is accompanied by seven illustrations. "The Nature and History of Patent Rights" is an important address by E. L. Thurston. The new "French Flashless and Soundless Gun" is also described.

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RECENTLY PATENTED INVENTIONS.

Bicycle-Appliances.

ADJUSTABLE HANDLE-BAR.—Morgan H. Vanervera, Little Falls, N. Y. The stem of the handle-bar at its upper portion is slotted at opposite sides. In the upper portion of the stem a horizontal part is mounted to turn, which is provided with an annular series of ratchet teeth alined with the slots in opposite sides of the stem. Pawls are pivoted in the stem opposite each other and in a position to engage the teeth of the horizontal portion. The shanks of the pawls being raised, the handle-bar can be adjusted to the desired position, even when the bicycle is going at full speed.

WATER-CYCLE. — John J. McClimont, Union, Hudson County, N. J. The cycle is provided with a number of floats upon which the frame of the machine is carried. The cycle is driven by means of a pedal-crank mechanism which actuates propellers through the medium of bevel-gears and connecting rods. The device is guided by means of a hand operated steering-wheel connected by chains and sprockets with the front float.

DRIVING-WHEEL FOR CYCLES.—William H. Chapman, London, E., England. This invention seeks to provide a driving-wheel which can be removed without dismounting the driving-chain and gear-case. The wheel-hub is constructed in two portions, so coupled together that, by merely withdrawing the central spindle and unfastening the coupling, the wheel may be removed along with one of its bearings, the other bearing, together with the sprocket-wheel, driving-chain, and gear-case, being left *in situ* in the frame.

BICYCLE-TIRE ARMOR.—Emil H. Haupt, Manhattan, New York city. The steel armor extends across the tread and at the sides of the tire, and is formed with opposing ends. Clamps are adapted to support the end portions of the armor. A spring tension device connected with the clamps serves to draw the ends of the armor toward each other and to provide a means whereby the armor will yield lengthwise to such an extent as not to interfere in any appreciable degree with the elasticity of the tire.

Mechanical Devices.

GLASS-MOLDING MACHINE.—Henry Bastow, Indiana, Pa. The machine comprises mechanism for holding the molten glass as the blow-plunger is dipped therin. Guide-plates are mounted adjacent to the mechanism, and between the guide-plates a carriage slides which is adapted to deliver the molten glass to the glass-holding mechanism. A block is independently slidable on the carriage and has a knife which severs a portion of the molten glass. The glass, after having been thus separated into masses sufficient to form jars or bottles, is pressed into an approximate form, and, after having attained this form, is molded or blown into the exact form.

BRICK-PRESS.—Sylvester Taylor, Center, Indian Territory. Mounted to turn in the frame of the press is a vertically-disposed shaft carrying a number of arms horizontally. Each arm has a mold in which a plunger reciprocates vertically. Feed-devices supply the molds as they turn with the shaft. A cover-plate is supported above the frame and is connected with an eccentric shaft by means of which the plate is caused to move to and from the molds. A vertically-movable bar is adapted to engage the plungers and push them up. The bar is located at a point beneath the cover-plate, to compress the brick. A fixed segment is located at one side of the bar, and is adapted to have the raised plunger movable over the upper face of the segment. Mechanism is mounted at the end of the segment opposite the vertically-movable bar, by which to raise the plungers further in order to dislodge the brick from the mold.

AUTOMATIC KEG-SOAKING APPARATUS.—Charles Zies, Baltimore. Md. It is the object of this invention to provide an improvement in that class of troughs for soaking beer-kegs which are provided with automatic apparatus for causing the kegs to roll through the tank to a scrubbing-machine. The inventor has devised improved means for submerging the kegs in the water contained in the tank, and for causing the kegs to roll and travel from one end of the tank to the other, where an improved elevating and delivery mechanism is arranged for automatic co-operation with the means for submerging. The inventor furthermore provides an improved guard for regulating the admission of kegs to the tank, which guard operates automatically in connection with the other mechanism referred to.

Engineering-Improvements.

AIR-COMPRESSOR.—Henry E. Anderson, Cheboygan, Mich. The air-compressor comprises a cylinder having guideways therein. Weights have a limited reciprocation in the guideways, and are connected with the piston of an air-compressing cylinder. As the weights reach the top of the mechanism, they have a tendency to slide toward the opposite end of the guideways. As the weights drop, they move the piston of the air-compressor, and thus compress a certain quantity of air. From the arrangement of weights it follows that a complete double stroke of the air-compressing piston is produced during each revolution of the device.

TRACTION-ENGINE.—George Cashmore. Oakland, Cal. To provide an improved traction-engine, arranged to be driven by a gasoline or oil engine, and to be readily movable from place to place, is the purpose of this invention. The novel features of the invention are found in an ingenious reversing device, comprising a driven shaft on which clutch gear-wheels are loosely mounted, a double clutch mounted to turn with and to slide on the shaft to engage either of the clutch gear-wheels, and intermediate gear-wheels adapted to move simultaneously in or out of mesh with the clutch gear-wheels. A shifting-lever is provided for the clutch and is connected with the intermediate gear-wheel to shift the latter on moving the clutch.

Railway-Contrivances.

CAR-STEP.—Stephan Oliger, Burkettsville, Ohio. This invention seeks to furnish a simple means whereby, when occasion requires, the number of steps of a car-platform may be increased, and the additional step or steps be held as firmly in place as the regular steps. The lowermost of the car-steps is pivoted; and by this pivoted step an extension-step is carried. The pivoted and extension steps can be operated by means of a shaft mounted upon the car-platform and is crank-connected with a flexible pitman joined to the pivoted step by a link. Mechanism is connected with the pitman for springing the pivoted step past the center of its pivot, in order to form a continuation of the regular steps.

COMBINED AIR-OPERATED CAR-COUPLING AND TRAIN-PIPE-COUPLING MECHANISM.—John S. Bubb, Kittanning, Pa. The present invention provides a quick-action pneumatic mechanism for automatically setting the coupling-pin to its coupling position. The mechanism is adapted to be set in operation to move the pin to its uncoupling position by hand-manipulated release devices operated either from the sides, top, or other portion of the car. The invention embodies a novel arrangement of coupling means for joining the train air-pipes, which means coact with and form part of the air-operated coupling-pin adjusting mechanism. There is also comprehended in the invention a construction of air-operated means for setting the coupling-pin to its uncoupling position, hose-coupling devices coacting therewith, and an air-brake mechanism combined with such devices and forming an interdependent part of the complete structure of the improvement, but capable of being operated independently of the air-operated coupling-pin and hose air-coupling devices.

Miscellaneous Inventions.

CANE-SLING.—Daniel H. Walsh, Plaquemine, La. This cane-sling consists of a novel arrangement of chains and hooks, the chains being passed around the cane and the hooks engaging the chains. The sling is to be used in transferring sugar-cane, sorghum, and the like from carts to railroad cars, and is primarily designed to keep the package intact, so as to facilitate handling.

SURGICAL SPLINT.—Robert W. Barton, Marion, Kans. Primarily this invention is designed to provide a simple form of splint for use in the treatment of compound and comminuted fractures, and is so constructed that extensibility can be effected without the use of weights, and without rearranging the bandage. The splint comprises two sections or base portions of pliable material secured in proper position on the limb, and a bridge-portion connecting the two pliable sections so as to maintain them in an immovable position after adjustment. The surface of the injured portion can hence be left free for treatment without affecting the setting of the splint.

BINDER-FRAME.—Harvey P. Jones, Chicago, Ill. The binder is provided with a main frame, with top and bottom clamping-plates fitted to slide toward and from each other in the main frame, and with a right and left hand screw mounted to turn in the main frame, and engaging nuts on the clamping-plates. The device forms a detachable leaf-binder for books of any kind and so binds the leaves that they are separately movable and interchangeable, the operator being enabled readily to open the clamping plates by turning the screw for the insertion and removal of a leaf.

WINDMILL.—Hans H. Bergsland, Red Wing, Minn. The mill is provided with blades or wings which turn in a horizontal plane and which are carried on a vertically extending tower-shaft, and is furthermore provided with a centrifugal governor which serves automatically to regulate the speed. The novelty of the invention resides in the manner of mounting the blades in their casing so that they may be automatically feathered by the governor, according to the velocity of revolution of the main shaft, and according to the previous adjustment of the governor, by which adjustment a maximum speed may be set and maintained. Another novel feature is found in the hand-operated means located at the foot of the tower and connected with the governor to start and stop the mill.

GRAPHOPHONE.—Inocenio Andion, New York city. This improvement in graphophones seeks to increase the volume of the sound in a reproducer or in a recorder, to secure a more perfect recording action by concentrating the sounds and preventing the scattering or loss thereof. This object is attained by making the recorder or reproducer in the form of an exterior shell, and providing it with a diaphragm-holder smaller than the shell and spaced therefrom peripherally so as to form an annular chamber between the shell and the holder. In the holder two spaced diaphragms are located. The holder is apertured peripherally between the diaphragms so that the chamber communicates with that between the shell and diaphragm holder.

FLUE-STOPPER.—William D. Powley, Lexington, Ill. The present invention provides a device for closing the flues in chimneys and walls when the stove-pipes have been removed, so that the flues will not present an unsightly appearance. The device embodies a cap to which two clamping-arms are pivotally connected, such arms being actuated by a sliding cross head, all of the parts having a peculiar construction by which the stopper is made more effective in operation than most devices of its class.

CAP.—Charles J. Holzenthaler, Brooklyn, New York city. The cap provided by this inventor is designed to retain its original shape long after other caps would have become shapeless. To this end, a metallic stiffener has been employed consisting of a continuous sheet-metal rim for the side of the crown, the rim being formed at its upper edge with an inturned annular and integral flange serving as a support for the top of the crown.

BELT-FASTENER.—Russell Fraser, Brooklyn, New York city. This belt-fastener consists of a continuous lacing woven back and forth to join the ends of the belt. The lacing has its parts secured together at a number of points intermediate its ends, whereby it is formed into independent loops, thus preventing the withdrawal of the entire lacing upon the breaking of one or more of the loops. A number of strands may break without affecting the strength of the lacing to any appreciable extent.

UMBRELLA-TOP PROTECTOR.—William O. Forsyth, Trinidad, Col. The covers of umbrellas and parasols are subjected to considerable wear at the upper end of the ribs. It is the purpose of this invention to provide a device for the protection of these portions. This device consists of a cup-shaped body of rubber, provided with external ribs. The body fits upon the tip of the stick and entends down over the cover below the pivots of the ribs and is provided with staples for securing it to the ribs.

CLIMBER.—Charles H. Cole, Brooklyn, New York city. The present invention provides a climber for the use of riggers and linemen. The climber comprises a shank having an opening in its lower portion, a boxing, and a spur having a plate extended through the opening and secured in the boxing. The spur may be easily removed for the purpose of sharpening or repairing it.

Designs.

FOOT-BRAKE DOG.—Eugene B. Gray, Manhattan, New York city. The leading feature of this design resides in a guard located on the dog-arm, and extending beyond the arm. The foot-brake dog, as a result, is more easily operated than most devices of a similar character.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please send the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

Cuba: Its Resources and Opportunities. By Pulaski F. Hyatt, United States Consul, and John T. Hyatt, United States Vice Consul, Santiago de Cuba. New York: J. S. Ogilvie Company. 1898. Pp. 211. Price $1.50, paper 50 cents.

The book gives valuable information for American investors, manufacturers, exporters, importers, lumber and mine operators, wholesale and retail merchants, employment seekers, prospective planters, professional men, sportsmen, travelers, railroad men, and others. The book gives exactly the kind of information that people are now beginning to ask regarding the great islands at our gates. The book being written by the United States Consul and Vice Consul of Santiago de Cuba is, of course, authoritative. The book is cheaply made, but the illustrations give some idea of the kind of stores which may be found in Cuba. The tables deal with the commerce of Cuba, and are excellent. Part of the book is given up to a business directory of Havana, Santiago, Matanzas, and other cities. We hardly expected to find a business directory of these cities in such concise form so soon.

Marine Boilers. Their Construction and Working, Dealing More Specially with Tubulous Boilers. By L. E. Bertin. London: John Murray. 1898. 8vo. Pp. 437. Price $7.20.

The author is the chief constructor of the French navy. It is translated and edited by Leslie S. Robertson, the well known mechanical engineer, and there is also a short preface by Sir William H. White, director of naval construction to the British Admiralty. The author has long been known as an authority on marine boilers. It is not limited to boilers on war vessels, as might be supposed. The work is profusely illustrated with clear diagrams, which are reproduced on a large scale. It should be noted that the present volume treats of the very latest practice in marine boiler construction, and on this account should not be confused with the books which have already been long on the market. While the French practice differs in many respects from English and American practice, at the same time, the author has shown such an intimate familiarity with the work of other countries that his book is not at all injured thereby. It is a most admirable book, which we can heartily recommend.

Das deutsche Patentgesetz und die wissenschaftlichen Huelfsmittel des Ingenieurs. By Prof. A. Riedler. Berlin: Julius Springer. 1898.

This is a reproduction, in pamphlet form, of an article published originally in the Zeitschrift des Vereins deutscher Ingenieure. The subject treated in the pamphlet will be interesting to patent lawyers, on account of the clear and able exposition of what may be termed "scientific" inventions, that is, inventions based upon the logical train of reasoning of a well educated mind, rather than upon the utilization of more or less accidental discoveries. Apart from the abstract question treated, the subject is of special interest on account of the example referred to very fully, namely, Schlick's German patent for his system of balancing multiple crank engines, which system is now well known in naval engineering. The patent was declared void by the German patent office, but upon appeal was upheld by the Supreme Court of the German empire. Prof. Riedler was one of the experts appearing in Schlick's behalf, and is therefore particularly fitted to give a history of this important patent cause.

The Sanitary Condition of City and Country Dwelling Houses. By George E. Waring, Jr. New York: D. Van Nostrand Company. 1898. 16mo. Pp. 130. Price 50 cents.

The tragic death of the great sanitary engineer would alone make the second revised edition of this booklet worthy of notice. We know of no book which gives information of so much value in such a small compass. The information is of the greatest scientific value, and is pithily conveyed in clear language which those who are interested in the subject will have no difficulty in understanding. It is a most valuable little book, and we congratulate the publishers upon the publication of what is probably the last work of Mr. Waring.

The Romano-British City of Silchester. By Frederick Davis, F.S.A. London: William Andrews & Company. 1898. 8vo. Pp. 62.

The city of Silchester will always be interesting to the archæologist, and the present study of Mr. Davis is an admirable resumé of the excavations which have been made and the results which may be produced from them. It is reprinted from "Bygone Hampshire."

Business and Personal.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7614) A. B. asks: What is a standard candle power and an easy way in which I can measure the candle power of a kerosene lamp? A. A unit of light, one candle, is the light given out by a sperm candle weighing six to the pound and burning 120 grains per hour. A wax candle may be weighed, burned 5 or 10 minutes, and again weighed. This will test the candle. If it consumes nearly the proper quantity, it may be used as a standard candle. Druggist grain weights will answer for weighing the candle. Fasten a sheet of white paper so that the candle will illuminate it. Place the candle one foot from the paper, and a lead pencil 3 to 4 inches from the paper so that its shadow cast by the candle will fall on the paper. Now place the lamp to be measured so that the shadow of the pencil which the lamp will produce may fall by the side of the shadow cast by the candle. Move the lamp to and fro till the two shadows are of equal intensity. Measure the distance of the lamp from the sheet of paper, in feet and fractions of a foot. The square of this number is the candle power of the lamp.

(7615) F. S. G. asks: 1. Which is better for the secondary of a 2 inch spark induction coil, double cotton covered wire or single silk covered wire, both in regard to insulating qualities and space it will require? A. For the secondary of an induction coil use single silk-covered wire rather than double cotton-covered wire. Neither covering has any insulating qualities. No porous covering can insulate a wire any more than the air in the pores insulates it. The object of the covering is to prevent contact. Insulation is had by shellac after a layer is wound on. 2. Can you tell me any way to straighten the No. 18 B. & S. iron wires, 11½ inches long, used to make the core of the above coil? I find that to straighten them by hammering is a very tedious task. A. To straighten a wire, fasten one end in a vise, or around a stiff nail, driven in any convenient place. Fasten the other end to a bar of wood or iron and pull till the wire is taut and straight as a line. Wire as heavy as 14 or 12 can be straightened by one man's strength. More power can be put upon larger wires, using a vise and a screw or lever. Any length can be straightened at one time. Cut it up after it is straightened.

(7616) W. A. G. C. asks: Can ice be made colder than 32 degrees? A. Water cannot under ordinary conditions be cooled below 32°. It turns into ice at this temperature. But a block of ice behaves in all respects like a block of any other solid, a piece of stone or iron for example, and may be cooled to any temperature whatever below its melting point. Out of doors on a winter's night with the thermometer indicating zero, the ice and snow will be at a temperature far below 32°. In an ice machine the ice in the cans after the freezing is completed may be cooled below 32° by the brine, and will then cool a refrigerator more than ice which is at 32°.

(7617) C. I. W. asks: 1. What number of wire should I use on local magnets for short circuit work (such as electric bells and telegraph sounders)? A. No. 28 or 30 wire may be used for sounders. On a short circuit less battery is required. The sounder is usually wound for a local circuit, and the relay with many turns for the line. 2. I wish to build an eight light 16 candle power dynamo with round armature? What Supple-

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MENT can I find this information in ? A. SUPPLEMENT, No. 600, price 10 cents, will furnish you plans and instructions for an eight light 50 volt dynamo. 3. What is a good soldering fluid for soldering brass ? A. There are several non-corrosive soldering pastes on the market. These are far better than the soldering fluid made of muriatic acid and zinc. Address dealers in electrical supplies.

(7618) H. J. D. asks: Is it possible for a man to know the direction in which he is going if he were inclosed in a box with nothing except a compass ? A. Most certainly, unless the box were of iron, with a thickness of ¼ to ½ an inch. Is not the needle of an ordinary compass inclosed in a box made of brass and glass ? Is not a compass, when in a house, inclosed in a box of wood or brick or stone ? It will point toward the north indoors just as well as in the open air.

(7619) W. L. W. asks: What metals expand and contract most from the effects of heat and cold, between the degrees of freezing and 100° above zero, and of those how much will they expand and contract? A. The figures given below are called coefficients of expansion. They are the amounts by which a piece of the metal 1 inch long is expanded in length on heating it 1 degree Fah. Brass, 0·0000104 inch ; aluminum, 0·0000136 inch; lead, 0·0000163 inch; tin, 0·000 124 inch ; zinc, 0·0000162 inch. From these numbers you can easily calculate how much a piece of any length will expand on heating it from freezing to 100 degrees. To find the length of a bar at any required temperature, measure its length and temperature. Then find the number of degrees it is to be heated or cooled. Multiply the coefficient of expansion by the number of degrees the bar is to be heated, and this by the length of the bar. The product is the expansion. To this add the original length. If the bar is to be cooled, subtract the expansion instead of adding it.

(7620) G. F. C. asks how to magnetize a 6 inch compass needle by electricity. Please give size of wire, number of turns, length of coil, size of core, and number of cells of 5 by 7 gravity battery (if that kind will do) to magnetize to saturation. A. Make a coil of wire of about No. 16 and of such a size that the needle to be magnetized shall be wholly within it. Connect the coil to the battery and let the current flow through the coil for a little while. No core is wanted in the coil. The needle is the core. Size of battery not important. One cell will do the work, more will do it quicker. You can test the needle by counting the number of swings it will make in a minute. Repeat the magnetizing till further magnetizing does not make it swing any faster.

(7621) R. J. P. asks how white ink is made. A. 1. Triturate together 1 part of honey and 2 parts dry ammonia alum. Dry thoroughly, and calcine in a shallow dish over the fire to whiteness. Cool, wash, and rub up with enough gum water to use. 2. Fine French zinc white, or white lead, rubbed up with gum water to the proper consistency. 3. Mix pure freshly precipitated barium sulphate, or flake white, with water containing enough gum arabic to prevent the immediate settling of the substance. Starch or magnesium carbonate may be used in a similar way. They must be reduced to impalpable powders. 4. White Ink for Blue Paper.—Use oxalic acid and water. This bleaches the paper, leaving white lines.

(7622) A. O. writes: I would like to ask you how long the patents have been running on revolving or rocking grates, such as used in locomotive boilers, heaters, etc.? A. The first patent on such grates was granted to Eliphalet Nott, the former celebrated president of Union College, Schnectady, N. Y. It rocked on a horizontal axis and was made in different shapes. It was used in his stoves, which were widely known. The Nott patents describe the grates as applicable to "furnaces of every sort." A grate adapted to revolve horizontally and stated to be applicable to steam engine boilers was patented in England in 1819.

(7623) J. A. S. asks: 1. Is man originally a natural meat eater, or only by habit? A. The possession of teeth adapted for eating both vegetable and animal food is understood to indicate man's original adaptiveness to eat both. 2. If you heat one end of a piece of very fine wire one hundred feet long, will any heat or molecular motion be transmitted to the other end ? A. That depends on the kind of wire and the temperature of the surrounding space. It is not, however, probable that so long a wire could be heated perceptibly 100 feet from the source of heat. 3. What is the principal use of the condenser in connection with the steam engine ? A. The condenser reduces the pressure by nearly one atmosphere on one side of the piston of a steam engine. 4. If the sound of several different instruments, playing at the same time on the same note (C for instance), be transmitted to the record of graphophone, will there be a separate impression for each instrument or one for the combined sound? A. The combined or resultant vibration of the diaphragm is recorded by the stylus of a phonograph and all similar instruments.

(7624) C. B. asks if a common magnifying glass can be substituted for a camera lens. If there is any particular kind or size, I wish you would mention them. If they cannot be used, please state why not. A. A common magnifying glass can be used for a camera lens in taking landscapes by covering all of it but a small circle in the middle. If your lens is 2 inches in diameter, cover all but ¼ to ⅜ inch of the middle. If a large opening is used the center of the picture and its edges will not be in focus at the same time. Look up "Spherical Aberration" in any text book of physics.

(7625) E. H. H. asks: How are the high temperatures produced and measured as produced in some chemical laboratories? A. The highest temperatures produced on the earth are produced by the electrical furnace. The apparatus for the measurement of the temperatures is based upon the expansion of gases, upon the specific heat of the substances, and upon the laws of thermo-electric currents. A thermo-electric couple composed of platinum and palladium will work up to the melting point of palladium, which is 1,700° C., and one made of platinum and an alloy of platinum and rhodium will measure temperatures up to 1,200° C. with an error of less than 10°.

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MARCH 14, 1899,

AND EACH BEARING THAT DATE.

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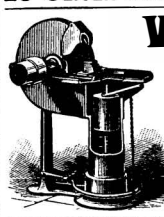

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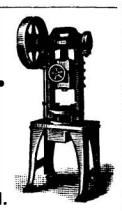

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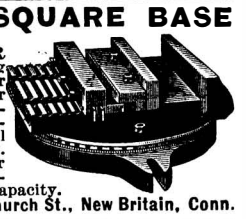

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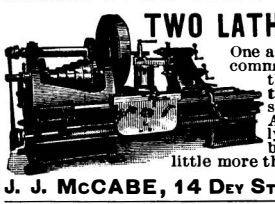

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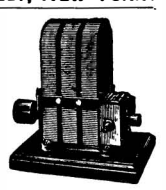

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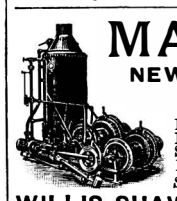

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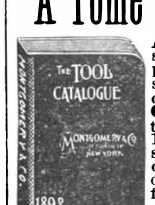

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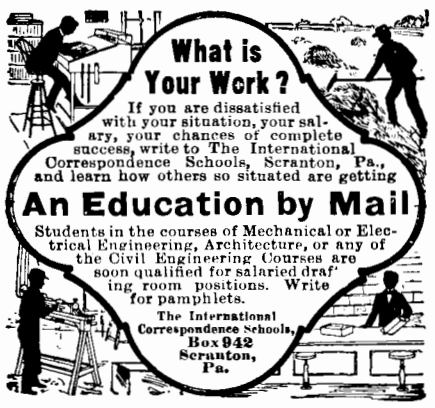

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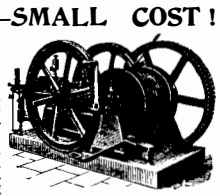

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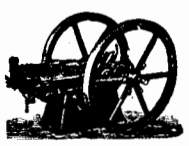

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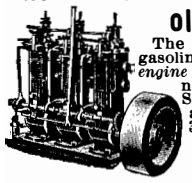

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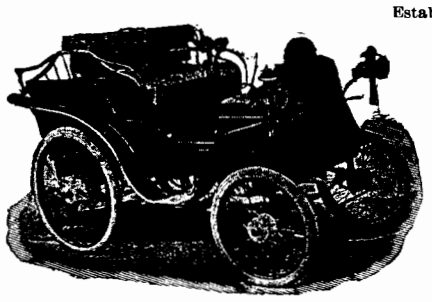

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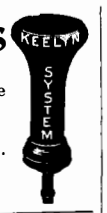

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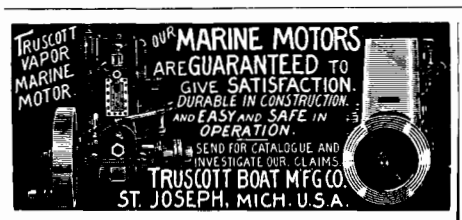
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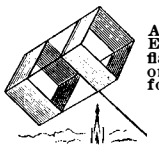

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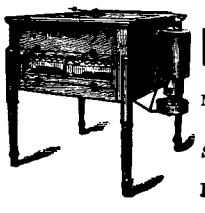

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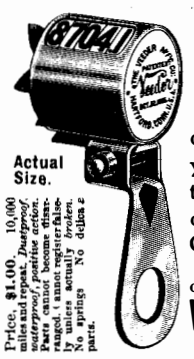

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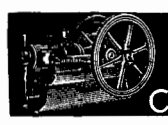

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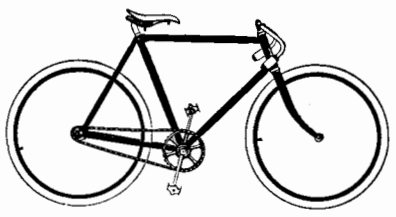

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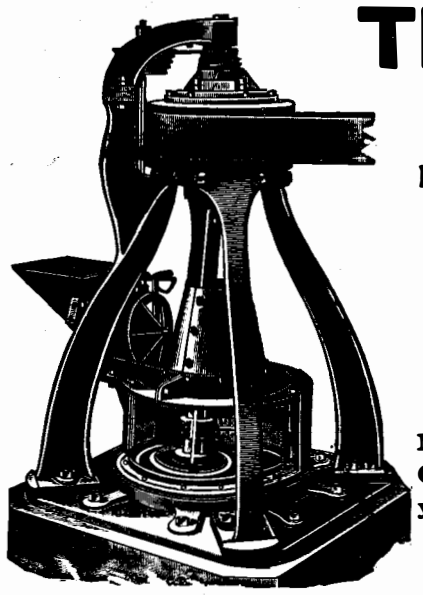

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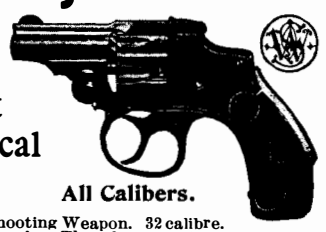

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